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SUPPLEMENT

MATHEMATICAL
TEACHING AIDS

COMPILED BY
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Chicago Teachers College

CHICAGO SCHOOLS JOURNAL

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FOREWORD

Nearly five years ago the CHICAGO SCHOOLS JOURNAL began the publication of a series of supplements dealing with teaching aids other than textbooks. There have been issues in the general fields of the language arts, the social sciences, the natural sciences, and mathematics, and in several special fields of children's literature. Sometimes the supplements confined their scope to free and inexpensive teaching materials; sometimes the coverage was larger. The first supplement on mathematics, dated January-February, 1950, was entitled *Mathematical Teaching Aids*, and was compiled by Joseph J. Urbancek, Chairman of the Department of Mathematics of the Chicago Teachers College.

The present issue, with the same title and by the same compiler, is a much more ambitious undertaking. With the aid of a staff recruited not only from associates in the Chicago Teachers College, but from other institutions, it presents materials at all levels of general education in mathematics and in all areas except pupils' textbooks and workbooks.

The eager demand for preceding numbers of this series of supplements convinced the editors and staff that this type of publication meets an important need of teachers in service and teachers in training.

RAYMOND M. COOK, Editor

Dean, Chicago Teachers College

FRONT COVER DESIGN BY RUTH M. DYRUD

BACK COVER DESIGN BY JOHN W. EMERSON

DEPARTMENT OF ART, CHICAGO TEACHERS COLLEGE

MATHEMATICAL TEACHING AIDS

COMPILED BY JOSEPH J. URBANCEK, CHICAGO TEACHERS COLLEGE

FILMS AND FILMSTRIPS

All films are 16 mm sound, and one reel in length unless otherwise indicated; all filmstrips are 35 mm.

The information on films and on filmstrips was obtained directly from the available sources that supply them. With each entry, the source from which the item may be obtained is shown in abbreviated form. The complete name and address of each source may be obtained by consulting the directories on pages 22 and 23.

It should be noted that experienced teachers are well aware that:

films and filmstrips are *not* substitutes for good teaching but are valuable teaching aids.

some films and filmstrips are much more worthwhile and necessary than others; selection is important.

some films and filmstrips are very helpful over a wider area than the principal category into which they are placed in these sections; choice is limited but will vary according to adaptability.

FILMS FOR PRIMARY GRADES

*Addition Is Easy.*¹ 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: F. Lynwood Wren. Coronet.

Establishes the basic concepts of addition and demonstrates the methods which are an important foundation for the study of arithmetic. Motivated through the use of Billy who needs a set of paints but also wants a baseball bat.

Arithmetic for Beginners. Three parts, 7 minutes each. B & W, \$32.50 each; set of three, \$90. Rental, \$2.00 each. Educational Collaborator: Constance Amsden. Bailey.

Models of farmyard animals are shown moving into the picture to aid in teaching the concepts of addition, and are shown departing to show the concepts of subtraction. Many variations are used to work out the numerous basic concepts.

Helping Children Discover Arithmetic. 15 minutes. Rental: B & W, \$3.00. Teacher's Guide. Wayne.

Designed to help children discover the concept of borrowing in subtraction.

Let's Count. 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: F. Lynwood Wren. Coronet.

Introduces the child to systematic counting, motivated by Sally and Joe who demonstrate how useful counting can be as they progress from tally marks and numerical symbols and learn the difference between ordinal and cardinal numbers.

*Let's Measure: Inches, Feet, and Yards.*¹ 11 minutes. B & W, \$50; color, \$100. Educational Collaborator: F. Lynwood Wren. Coronet.

The concepts of the units of measure are developed by Jimmy and his father as they examine a ruler together.

*The Meaning of Plus and Minus.*¹ 11 minutes. B & W, \$50; color, \$100. Rental: B & W, \$2.50; color, \$4.00. EBF.

Builds the concepts of combining and separating familiar objects through a combination of photography, music, and words.

**Parts of Nine.* 11 minutes. B & W, \$50. Educational Collaborators: William A. Brownell and Laura K. Eads. YAF.

Develops the meaning of number 9 through the use of concrete materials involved in preparing for a birthday party. Presents 9 in serial relation, as groups of three, and in addition and subtraction facts.

¹Also usable for intermediate grades

*Available to the Chicago Public Schools through the Division of Visual Education

**Parts of Things.*¹ 10 minutes. B & W, \$50. Educational Collaborators: William A. Brownell and Laura K. Eads. YAF.

Develops the meanings of $\frac{1}{2}$ and $\frac{1}{4}$ in single things. Experience situations, concrete objects, and semi-concrete situations are used to develop the abstract ideas of $\frac{1}{2}$ and $\frac{1}{4}$.

*Subtraction Is Easy.*¹ 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: F. Lynwood Wren. Coronet.

A companion film to the one on addition. Children see how Billy faces the problem of buying a baseball in addition to the paints and bat. Borrowing, place value, and other fundamentals of subtraction come into play.

**Teen Numbers.*¹ 10 minutes. B & W, \$50. Educational Collaborators: William A. Brownell and Laura K. Eads. YAF.

Develops the meaning of place value. The meanings of numbers 1-9 are shown through grouping objects; 10-19 through groups of a 10 and 1's and as they are shown in relationship to single-digit numbers.

**What Is Four?*² 1½ reels. 15 minutes. B & W, \$62.50. Educational Collaborators: William A. Brownell and Laura K. Eads. YAF.

Illustrates the number 4 in a variety of concrete, semi-concrete, and abstract situations.

*What Time Is It?*¹ 11 minutes. B & W, \$50; color, \$100. Educational Collaborator: F. Lynwood Wren. Coronet.

Develops the concept of telling time by the clock and by the calendar with the aid of Barbara; helps children discover how telling time helps us to work together.

FILMSTRIPS FOR PRIMARY GRADES

Arithmetic Combinations.^{1, 2} 4 sets of 4 filmstrips in each set. B & W, each set, \$8.00; the 4 sets, \$30. Teacher's Manual free, with or without purchase. Educational Collaborators: Louise Farwell Davis and Joseph J. Urbancek. Sixteen titles. Number of frames varies from 35 to 77 per filmstrip. SVE.

Addition Combinations: Fifteen Easiest Combinations; Thirty Easy Combinations; Nineteen Zero Combinations; Thirty-six More Combinations.

Subtraction Combinations: Fifteen Easiest Combinations; Thirty Easy Combinations; Nineteen Zero Combinations; Thirty-six More Combinations.

Multiplication Combinations: Groups I-IV.

Division Combinations: Groups I-IV.

Designed to teach number combinations by flash recognition at speeds of from bulb and time exposure to 1/100 of a second. Frames are so arranged that number combinations or number facts may be taught, or an alternation between the two by exposing the frames in consecutive order.

*Arithmetic Experiences.*¹ A series of 8 filmstrips that average 25 frames per strip. Color, each, \$3.95; set, \$24. EP.

Words for Comparison; More or Less; Cooking by Measure; Buying by Measure; Wholes and Parts; Things in Groups; Advanced Buying by Measure; Advanced Wholes and Parts. Various types of materials are used, in suitable settings, to help children understand the meanings that the titles suggest they should master.

Arithmetical Experiences for the Third Year. A series of 9 filmstrips. Color, each, \$4.00; set, \$25. EGH.

The Game of "How Many?"; Experiences With Measurements; More Experiences With Measurements; Experiences With the Thermometer and With Money; Experiences With Time; Experiences With Counting; Experiences With Numbers; Experiences With Comparisons; Experiences With Fractions. Aimed at associating everyday experiences with arithmetic.

²Also usable for upper grades.

Bridging the Decades. A series of 9 filmstrips. Color, each, \$4.00; set, \$25. EGH.

Review — Work and Play With Number 11; Work and Play With Numbers 12 and 13; Work and Play With Numbers 14 and 15; Work and Play With Numbers 16 and 17; Work and Play With Number 18; Work and Play With Number 19; Work and Play With Number 20; Work and Play With Problems; Work and Play With More Problems. Designed to aid in understanding the numbers.

Compound Subtraction. 41 frames. Color, \$6.00. PSPC.

Shows the pattern to follow in subtraction.

How to Tell Time. Part I—45 frames, Part II—43 frames. B & W, \$3.00 each. PSPC.

Part I introduces the pupil to the concept of telling time; Part II, to telling time in minutes. Examples of telling time invite audience participation.

Materials for the Teaching of Arithmetic. 45 frames. Color, \$3.00. Manual free with purchase. OSU.

The frames in this filmstrip show the kinds of materials that may be bought or made and used for the understanding of arithmetic at all grade levels. Some items may be used at several levels; others have very limited use. The filmstrip without the manual is of little value.

A Number Family in Addition. 41 frames. Color, \$6.00. PSPC.

Shows sequence of activities essential in a basic number fact, and family of 7's in addition.

Number Recognition — Digits.^{1, 2} About 45 frames per filmstrip. B & W, set of seven. \$14. Teacher's Manual free, with or without purchase. Educational Collaborators: Louise Farwell Davis and Joseph J. Urbancek. Seven Titles. SVE.

Number Recognition: One and Two Digits; Number Recognition: Three and Four Digits; Number Recognition: Three to Five Digits; Number Recognition: Four to Six Digits; Number Recognition: Five and Six Digits; Number Recognition: Seven to Nine Digits; Number Recognition: Four Tests. Specially prepared filmstrips for flash training that develop skill in the recognition of numbers; designed to improve eye-hand-brain co-ordination and visual memory. The duration of the flash may be controlled by briefly exposing the frame at a given signal and then quickly covering the projector lens with a 3" x 5" card; or more accurately by the use of a tachistoscope.

The Threes. 44 frames. Color, \$6.00. PSPC.

Shows the sequence for teaching a table in multiplication.

The Twos in Division. 49 frames. Color, \$6.00. PSPC.

Shows the general concept of division and the basic facts of division.

What Numbers Mean. 41 frames. Color, \$6.00. PSPC.

Develops concept of numbers 1 to 10—concrete and abstract.

Using and Understanding Numbers. About 35 frames per filmstrip. Color, each, \$5.50; set of five, \$23.75; set of six, \$28.50. Free descriptive literature. Two Series. Educational Collaborators: Joseph J. and Francesca L. Urbancek. SVE.

Series for Kindergarten and Grade I. 5 titles: *Using and Understanding Numbers, 1-5; Using and Understanding Numbers, 5-9; Using and Understanding Numbers, 9-12; Learning to Tell Time; Learning About and Using Pennies, Nickels, and Dimes.* Shows through the use of small groups of familiar concrete objects the meaning of counting; provides for the associating of number symbols and oral number words, and the understanding of increasing and decreasing numbers. Usable in Grade II.

Series for Grades I and II, 6 titles: *Using and Understanding Numbers, 11-15; Using and Understanding Numbers, 16-20; Using and Understanding Numbers by 1's, 2's, 5's, 10's; Using and Understanding Addition—Objects and Symbols; Using and Understanding Subtraction—Objects and Symbols; Using and Understanding Simple Measures.* A continuation of the preceding series. Develops the ability to compare objects and groups according to size and provides for the development of basic principles in relation to simple addition, subtraction, multiplication, and division. Usable in Grade III.

Using Numbers. A series of 16 filmstrips. 560 frames. B & W, \$3.00 each; set, \$48. Educational Collaborators: John R. Clark and Caroline H. Clark. EBF.

Arranged in 16 lessons designed to teach the meaning, sequence, and use of numbers; rational counting; readiness for the next step; and to lay a foundation for problem solving: (1) *Counting to 5*, 38 frames. (2) *Counting to 10*, 44 frames. (3) *Reading Numbers to 10*, 45 frames. (4) *Writing Numbers to 10*, 36 frames. (5) *Counting by 10's to 30*, 35 frames. (6) *Counting by 10's to 50*, 29 frames. (7) *Counting by 10's to 80*, 30 frames. (8) *Counting by 10's to 100*, 37 frames. (9) *Counting from 10 to 15*, 39 frames. (10) *Counting from 15 to 20*, 36 frames. (11) *Counting from 20 to 40*, 36 frames. (12) *Counting from 40 to 100*, 34 frames. (13) *Reading Numbers to 50*, 28 frames. (14) *Reading Numbers to 100*, 31 frames. (15) *Writing Numbers to 100*, 32 frames. (16) *Working with Numbers to 100*, 30 frames.

Work and Play With Numbers. A series of 9 filmstrips. Color, each, \$4.00; set, \$25. EGH.

Arithmetical Concepts; We Learn Numbers; We Learn Numbers, Part II; Time and Money; Addition and Subtraction Concepts; Work and Play With Numbers 5 & 6; Work and Play With Numbers 7 & 8; Work and Play With Numbers 9 & 10. Planned to give the child an understanding of numbers.

Zero — A Place Holder. 45 frames. Color, \$6.00. PSPC.

Shows meaning of 10, 20, 30, and 40 with pennies and dimes.

FILMS FOR INTERMEDIATE GRADES

*A Day Without Numbers.*² 10 minutes. B & W, \$40; color, \$75. Rental, \$3.00. Wayne.

Shows a boy who wishes for a world without numbers and the difficulties he encounters when he gets his wish. He appreciates the need for numbers so much that he has an interest in developing number skills.

*Airplanes and How They Fly.*² 10 minutes. B & W, \$50. Educational Collaborator: Gerald S. Craig. YAF.

An elementary discussion of the principles of aircraft flight. Also usable in senior high school with science classes.

**Bill Garman, Twelve-Year-Old Business Man.* X-G-14. Color. FF.

Shows a typical American boy who likes to be independent; how he raises rabbits and hogs and plans carefully to invest the money when they are sold.

Decimals Are Easy. 11 minutes. B & W, \$50; color, \$100. Educational Collaborator: H. C. Christofferson. Coronet.

Through the inductive method students are made to see that decimals are an integral part of our number system and that decimals function in our daily lives.

*Decimal Fractions.*² 11 minutes. B & W, \$50; color, \$100. JHP.

Introduces the decimal as a special form of common fractions. The concept of decimal fractions as an extension of our decimal system of number is not included.

**Division Is Easy.*² 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: F. Lynwood Wren. Coronet.

Helps children understand division, why it is important, and shows what to learn to master this basic fundamental process. It is a companion film to multiplication, and may be used in the primary grades. Usable for review.

How to Add Fractions. 11 minutes. B & W, \$50; color, \$100. JHP.

Reviews definitions related to common fractions and illustrates theory of addition in fractions.

How to Change Fractions. 11 minutes. B & W, \$50; color, \$100. JHP.

Primarily concerned with the reasoning behind the methods of finding equal fractions, and an explanation of why the new fraction is of equal value.

*How to Divide Fractions.*² 11 minutes. B & W, \$50; color, \$100. JHP.

Explains the reasoning which underlies the rules for inverting the divisor and multiplying. Usable for review and remedial work.

*How to Multiply Fractions.*² 11 minutes. B & W, \$50; color, \$100. JHP.

Illustrates the method of multiplying fractions and explains the theory of the method. The process of cancellation is not shown. Usable for review and remedial work.

How to Subtract Fractions. 11 minutes. B & W, \$50; color, \$100. JHP.

Reviews the definitions related to common fractions and illustrates the theory of subtraction in fractions. Usable for review and remedial work.

Introduction to Fractions. 11 minutes. B & W, \$50; color, \$100. JHP.

Illustrates the meaning of common fractions and shows how to determine the value of a fractional part. Usable for review and remedial work.

Maps and Their Uses. 11 minutes. B & W, \$50; color, \$100. Educational Collaborator: Erwin Raisz. Coronet.

How to read a map, scale of distance, grid, legend, and contour maps is shown through a variety of special purpose maps that aid in understanding the various topographical formations and the importance of maps in everyday living. Usable in upper grades and junior high school.

*Measuring Temperatures.*² 10 minutes. B & W, \$50. YAF.

Reading and understanding the thermometer is supplemented with an introduction of the principle of contraction and expansion.

**Multiplication Is Easy.* 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: F. Lynwood Wren. Coronet.

Demonstrates the procedure of multiplication, shows why the process is important, and gives the main steps in learning how to multiply. Ideas are associated with addition. May be used in the primary grades.

The Number System. 11 minutes. B & W, \$50; color, \$100. Rental: B & W, \$2.50; color, \$4. EBF.

Demonstrates the combining of objects into groups of ten and the counting of groups of ten by means of a variety of combinations.

**Using the Bank.*² 11 minutes. B & W, \$50. Rental, \$2.50. Educational Collaborator: John R. Clark. EBF.

Reveals the bank in its role as an agent of convenience in the handling of money through such media as the savings account, the checking account, and the lending of money.

*We Discover Fractions.*² 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: Harold P. Fawcett. Coronet.

Children are oriented into discovering fractions through a piece of pie, half an apple, a board sawed into fourths. Such words as numerator and denominator are conveyed through the medium of using two-thirds of a cup of milk for a layer cake.

What Are Decimals? 10 minutes. B & W, \$45. Films.

Designed to be a companion film to *What Are Fractions?*, it extends the concept of fractions through familiar mediums into decimals. It may be used alone in connection with the teaching of decimal fractions.

**What Are Fractions?* 10 minutes. B & W, \$45. Films.

Explains the concept of parts of things through such mediums as butter, pie, paint, yard goods, ink, carrots, and numerous other things familiar to children; also concept of parts of groups.

FILMSTRIPS FOR INTERMEDIATE GRADES

Adding Fractions. 29 frames. Color, \$3.95. EP.

Explains the greatest difficulty in adding fractions.

*Adding and Subtracting Decimals.*² 24 frames. Color, 3.95. EP.

Shows that in adding or subtracting decimals the decimal points must be placed under each other and that common sense will help students avoid errors in their computation.

*Addition and Subtraction.*² 30 frames. B & W, \$4.00. JHO.

The scope of addition and subtraction includes decimal points, carry-overs, unit borrowing, anticipation of results, simple computing methods, and checks for accuracy.

Addition and Subtraction of Fractions. 47 frames. B & W, \$4.00. JHO.

Shows how fractions behave. Demonstrates unlike and like units, common denominators and their usefulness, the action of mixed numbers, short cuts, and anticipation of results.

Adventures With Numbers. A series of 6 filmstrips; 284 frames. Color, each, \$6.00; set, \$31.50. PSPC.

Making Change; Two Figure Divisors; Zero in Multiplication; Meaning of Decimals; Dividing With Decimals; Dividing a Whole Number by a Fraction. The titles suggest the areas for which these filmstrips are planned.

Common Denominators. 25 frames. Color, \$3.95. EP.

Visualizes concept of a common denominator; reviews the importance of finding a common denominator and explains the process.

*Comparing Decimals.*² 26 frames. Color, \$3.95. EP.

Demonstrates comparing decimal fractions. Practice is provided and colors are used to facilitate teaching comparison of digits.

*Decimals and Common Fractions.*² 24 frames. Color, \$3.95. EP.

Develops a familiarity with decimal equivalents for halves, fourths, etcetera.

*Dividing Decimals.*² 25 frames. Color, \$3.95. EP.

Location of the decimal point is stressed as the main problem in dividing decimals.

Fractions of a Group. 27 frames. Color, \$3.95. EP.

Shows first that any group may have fractional parts (avoiding reducible fractions) and also introduces fractions of a group where the equal parts are more than one.

*Fraction Series.*² Series of eight; 343 frames. B & W, each, \$3.25; set of eight, \$24. Free descriptive literature. Educational Collaborator: Joseph J. Urbancek. Number of frames varies from 33 to 63 per filmstrip. SVE.

The Meaning of Fractions; Changing the Terms of Fractions; Adding Like Fractions and Mixed Numbers; Subtracting Like Fractions and Mixed Numbers; Adding Unlike Fractions and Mixed Numbers; Subtracting Unlike Fractions and Mixed Numbers; Multiplying Fractions and Mixed Numbers; Dividing Fractions and Mixed Numbers. Through the use of photographs and drawings of real objects, fractions and the principles used in computation are developed; various mathematical concepts which must be observed in adding, subtracting, multiplying, and dividing fractions and mixed numbers are explained; frames on the practical use of fractions in everyday life are included.

How Large Is a Fraction? 27 frames. Color, \$3.95. EP.

Develops the concept of relative size of the fraction; shows equivalence of fractions.

Introduction to Decimals. 23 frames. Color, \$3.95. EP.

Builds concept of nature of decimals; shows when preferable to common fractions.

Introduction to Fractions. Series of five; 111 frames. About 22 frames per filmstrip. Color, each, \$4.20; set, \$19.50. JHO.

Fractional Parts of a Whole and Groups $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$; Fractional Parts of Groups $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$; Fractional Parts of a Whole and Groups $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$; Non-unit Fractions of a Whole and Groups; Comparing Fractions.

Designed to develop the concepts of fractions through the use of picture situations.

Mixed Numbers. 26 frames. Color, \$3.95. EP.

Explains mixed numbers.

*Multiplication and Division.*² 70 frames. B & W, \$4.00. JHO.

A short method of addition and subtraction is explained. Tells when to use multiplication and division; shows the working form, contacting the decimal point, anticipating the results, short cuts, and checks.

Multiplication and Division of Fractions. 30 frames. B & W, \$4.00. JHO.

Shows indicated multiplication and division. Points out what really happens when fractions are multiplied or divided. Explains reductions, short cuts, and checks.

*Multiplying Decimals.*² 24 frames. Color, \$3.95. EP.

Establishes familiarity with common fractions, principle of adding the number of decimal places in two numbers to be multiplied, and finding the number of decimal places in the product.

Multiplying Fractions by Fractions. 26 frames. Color, \$3.95. EP.

Clarifies most troublesome points in multiplying fractions.

Using Mixed Numbers. 29 frames. Color, \$3.95. EP.

Defines and explains an improper fraction. The equivalence of a mixed number and an improper fraction to express the same fractional concept is reviewed. Practice in changing improper fractions to mixed numbers is given.

What Is a Fraction? 25 frames. Color, \$3.95. EP.

Explains the basic concepts of a fraction.

Writing Fractions. 26 frames. Color, \$3.95. EP.

Explains the significance of writing fractions with most stress on the number.

FILMS FOR UPPER GRADES AND JUNIOR HIGH SCHOOL

**Areas.* 10 minutes. B & W, \$50. KB.

Presents the needs and uses for finding areas of various figures. Shows clear, graphic demonstrations of recognized methods for the computing of areas of rectangles, parallelograms, triangles, and circles.

**Back of Every Promise.* X-S-79. B & W. CINB.

Familiarizes pupils with the things banks do for people, how the many necessities of life are brought from the soil, mines, forests, and factories to the consumers through the aid of banking operations.

**Banks and Credit.* 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: James Harvey Dodd. Coronet.

Shows the essential part a commercial bank plays in the economic life of a community and the important part credit plays in our economic system by showing what happens when money is deposited and checks are written.

**Bookkeeping and You.* 10 minutes. B & W, \$45; color, \$90. Educational Collaborators: Paul A. Carlson and Hamden L. Forkner. Coronet.

Explains the value of bookkeeping in every line of business and professional life as well as its importance in keeping a record of personal finances.

*Consumer Protection.*¹ 10 minutes. B & W, \$45; color, \$90. Educational Collaborator: Elvin S. Eyster. Coronet.

Shows how, by taking advantage of both government and private consumer services, prospective purchasers buy more efficiently, enjoy products of higher standards, and often avoid foolish mistakes by considering factors other than appearance when making purchases. May also be used in the intermediate grades

Federal Taxation. 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: W. J. Schultz. Coronet.

Outlines the system of federal taxation, personal and corporation income taxes, excise taxes, and taxes on luxuries and special services. Relates the material to how and why we pay taxes and what we get for our tax money.

**Fred Meets a Bank.*¹ 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: I Owen Foster. Coronet.

Gives inside story on banking procedures, handling checks, opening savings accounts, securing loans, safety deposit boxes, and bookkeeping. This is a tour through all departments of the bank.

How to Find the Answer (Mathematical Problem Solving.) 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: Harold P. Fawcett. Coronet.

Gives an exercise that can be utilized in solving problems in any subject; presents and demonstrates a procedure for working out problems after they have been established.

How to Think. 1¼ reels; 13½ minutes. B & W, \$62.50; color, \$125. Educational Collaborator: Carter Davidson. Coronet.

Related to methods of problem solving; the important elements of concentration, logic, observation, memory, imagination, and judgment are presented as part of the correct "way to think" by Dick who received a traffic ticket for driving a delivery car without a safety sticker.

Installment Buying. 11 minutes. B & W, \$45; color, \$90. Educational Collaborator: Albert Haring. Coronet.

Designed to teach students to think carefully the answers to three questions: (1) Is the article worth buying on the installment plan? (2) Can I afford it? (3) Am I getting the best installment terms? Useful also in senior high school; college; with adult groups; and in business, economics, social studies, and home economics classes.

Insurance Against Fire Losses. 1¼ reels. 14 minutes. Color, \$125. Rental, \$5.00. Educational Collaborator: Harry J. Loman. EBF.

Portrays the basic principle of spreading the risk through the use of cartoon-style color animation; emphasizes the activities that are carried on to reduce fire losses which help reduce the costs of insurance. Usable in senior high school.

The Language of Mathematics. 11 minutes. B & W, \$50; color, \$100. Educational Collaborator: Harold P. Fawcett. Coronet.

Students are aided in understanding the precise and meaningful symbols of mathematics, and are shown how problems are speedily and accurately solved; supplemented by graphs, dimensions, and numerical operations. Usable with high school classes.

Law of Supply and Demand. 11 minutes. B & W, \$50; color, \$100. Educational Collaborator: James H. Dodd. Coronet.

Students are taught how the law of supply and demand affects business. Through the use of graphs and familiar terms the film provides ideas for the discussion of many economic factors to which the law may be applied. Usable in senior high school with classes closely related to this field.

**Maps Are Fun.* 10 minutes. B & W, \$40; color, \$80. Educational Collaborator: Viola Theman. Coronet.

In preparing a map for a paper route, the boys learn from an experienced cartographer such fundamentals of map making as the legend, the scale, the grid, uses of color, how to read maps, and that maps can be very informative.

**Meaning of Long Division.* 11 minutes. B & W, \$50. Rental, \$2.50. Educational Collaborator: M. L. Hartung. EBF.

Explains the meaning of long division by showing that long division takes the place of a tedious succession of simple subtractions. Then, by means of animation, explains how the operation is simplified by grouping the subtractions. Usable in senior high school and in teacher training.

**The Meaning of Percentage.* 10 minutes. B & W, \$50. Educational Collaborators: William A. Brownell and Laura K. Eads. YAF.

Relates the meaning of percentage to hundredths both as fractions and as decimals. Percentage as hundredths is shown by graphic representation.

The Meaning of Pi. 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: Harold P. Fawcett. Coronet.

Develops an understanding of this mathematical ratio; outlines study procedure by which numerical value of pi can be checked and reviewed. Shows use in art, industry, and commerce.

*Measurement.*¹ 10 minutes. B & W, \$45; color, \$90. Educational Collaborator: Harold P. Fawcett. Coronet.

Shows how our lives, throughout every day, are affected and interwoven with measurement. Time; temperature; liquid measure; cubic, square, and linear measure permeate the fabric of society. Explains and highlights the importance of standardized measure.

**Origin of Mathematics.* 10 minutes. B & W, \$50; color, \$100. Rental: B & W, \$2.50; color, \$4.00. Brandon.

Starts with the mathematics of primitive man and shows its progress to modern methods. Usable in algebra classes.

Per Cent in Everyday Life. 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: H. C. Christofferson. Coronet.

Students learn how useful a working knowledge of per cent can be as they follow Bob's problems in figuring commissions, taxes, interest, and discount with general rate and base formulas.

*Percentage.*¹ 11 minutes. B & W, \$50; color, \$100. JHP.

Introduced as a special form of common fractions. Presents only those types of percentage problems which are generally classified as Case I and Case II.

Principles of Scale Drawing. 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: Harold P. Fawcett. Coronet.

Shows that scale drawings are the language of construction. Portrays children building a booth and how they learn to do such things.

**Property Taxation.* 11 minutes. B & W, \$50; rental, \$2.50. Educational Collaborator: H. F. Alderfer. EBF.

Applies the fundamental operations of arithmetic to the essentials of property taxation and shows graphically the practical expositions. Also suitable for classes in senior high school.

Sharing the Economic Risks. 11 minutes. B & W, \$45; color, \$90. Educational Collaborator: Paul L. Salsgiver. Coronet.

Illustrates the important aspects of property and life insurance and shows how, by the pooling of small sums, losses are shared by many thus saving an individual from large losses. Usable in senior high school with classes closely related to this field.

Time — The Servant of Man. 20 minutes. B & W. Rental at return express charges. MTPS.

Shows some of the methods used from earliest times to present day in telling time. An explanation between sun time and star time is given. An Elgin National Watch Company picture.

Understanding the Dollar. 11 minutes. B & W, \$50; color, \$100. Educational Collaborator: Elvin S. Eyster. Coronet.

Shows the essential purposes of money as a medium of exchange, the factors which affect the real value of the dollar, and how this changing value affects the lives of people with various sources of income. Usable in senior high school with classes closely related to this field.

**What Is Business?* 10 minutes. B & W, \$45; color, \$90. Educational Collaborator: Paul L. Salsgiver. Coronet.

Takes students on a trip around the world of commerce to see how familiar goods and services are produced and distributed in our profit-motivated economic system.

What Is a Contract? 10 minutes. B & W, \$45; color, \$90. Educational Collaborator: Dwight A. Pomeroy. Coronet.

Shows two youngsters who take summer jobs to buy things they wanted only to find themselves jobless and debtors within a short time. Through the use of a contract their situation is saved while they learn about mutual assent, competent parties, legal bargain, and consideration in both oral and written contract.

What Is a Corporation? 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: Raymond E. Glos. Coronet.

Shows the differences between the three principal forms of business ownership — single proprietorship, partnership, and corporation — and the advantages and disadvantages of each type.

**What Is Money?* 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: Paul L. Salsgiver. Coronet.

Follows a five-dollar bill through many transactions showing how money functions as a standard of value, future payment, storehouse of value, and medium of exchange; traces the evolution of money from primitive barter to modern checks which today serve as substitutes for money. Suitable for use in the upper intermediate grades.

**Work of the Stock Exchange.* 1½ reels. 15 minutes. B & W, \$60; color, \$120. Educational Collaborators: John V. Tinen and Sidney Parry. Coronet.

Students follow through each step of incorporation and listing of stock, details of buying and selling operations on the exchange floor and in the broker's office, and see how these operations bring to land, labor, and management the capital necessary for production. Also suitable for high school classes.

Your Family Budget. 11 minutes. B & W, \$50; color, \$100. Educational Collaborator: Mary E. Weathersby Pope. Coronet.

The importance of a budget, methods of preparation, and its values are shown. Students are brought to think about the value of a well-operated budget to the family well-being and happy family relations. Usable in senior high school with classes in social studies, business, economics, home economics, and for guidance.

**Your Thrift Habits.* 10 minutes. B & W, \$45; color, \$90. Educational Collaborator: Paul L. Salsgiver. Coronet.

Teaches setting up budgets, systematic savings, careful buying, avoiding extravagances, and choosing between immediate and future satisfactions.

FILMSTRIPS FOR UPPER GRADES AND JUNIOR HIGH SCHOOL

Areas. 49 frames. B & W, \$3.25. SVE.

Explains such mathematical concepts as the meaning of areas, the finding of areas of triangles, parallelograms, squares, and rectangles.

Budgeting for Better Living. 108 frames. Script. B & W, \$4.00; rental, return postage. HFC.

Presents a way of practical budgeting, while solving the family's problems.

Business Education Series. About 40 frames per filmstrip. Color, each, \$5.50. YAF.

Proper Handling of Checks; The Trade Acceptance. Of the six titles in this series, only the two listed are appropriate for the arithmetic areas their titles indicate. Usable in senior high school and college with classes related to the subjects.

Consumer Education Series: About 40 frames per filmstrip. B & W, each \$3.50; set of six, \$16.50. YAF.

Facts About Cotton Fabrics; Facts About Rayon Fabrics; Facts About Wool Fabrics; How to Buy a Blouse; Select Your Style; Your Retail Store. Designed to help students make more intelligent choices when buying fabrics and ready to wear garments; interspersed with quantity, quality, and number terms. Usable in senior high school and college with classes related to the subjects.

Dressing Well Is a Game. 77 frames. Script. B & W, \$4.00; rental, return postage. HFC.

Shows how to achieve a desirable wardrobe for every member of the family through the use of practical suggestions for planning, buying, and caring for clothes.

Flat Maps of a Round World. 56 frames. B & W, \$3.00. PSPC.

Shows how the globe grid may be transferred to a flat surface and highlights three important projections: the sinusoidal, the mercator, and the polar equidistant. Emphasizes longitude.

Fractions, Decimals, and Percentage. 59 frames. B & W, \$4.00. JHO.

Develops whole numbers to fractions, decimals, percentage, and back. Tells when it pays to use a decimal instead of a fraction, and when fractions are most practical. Emphasizes the importance of selecting the right form. May be used in the upper intermediate grades.

Graphs. 54 frames. B & W, \$3.25. SVE.

Calls attention to the current tendency of presenting stories and facts via pictures. Explains the correct steps which should be observed in drawing line, bar, and circle graphs; points out practical use. Also helpful in algebra classes.

Graphs. A series of 5 filmstrips that average 25 frames per strip. Color, each, \$3.95; set, \$15. EP. *Visualizing Number Facts—Pictographs; Bar Graphs; Line Graphs; Circle Graphs; Graphs in Daily Life.* Helps interpret the details necessary to understand the construction of the different kinds of graphs indicated by the titles. Helpful in algebra classes.

How to Stretch Your Food Dollars. 112 frames. Script. Color, \$6.00; rental, return postage. HFC. Nutrition-wise, budget-wise ideas for planning and buying food for the family.

International Date Line. 45 frames. B & W, \$3.00. PSPC.

Introduces concept of International Date Line, why it was necessary to create one, how it functions, and reason for its increasing importance in our age of rapid transportation.

Introducing Percentage. 26 frames. Color, \$3.95. EP.

Develops an understanding of the concept of per cent and shows why it is convenient to compare things on a base of 100. Usable in upper intermediate grades.

Maps and Men. 44 frames. B & W, \$3.00. PSPC.

Shows some of the many maps used in business, travel, various occupations, and the study of history and geography. Emphasis is placed on a variety of maps of the United States. The underlying generalization is that maps are useful to everybody.

Maps and Their Meanings. 53 frames. Color, \$6.00. PSPC.

Tells, in terms of children's own experiences, what maps are; how they indicate direction; how scale is used to show size; and how the simpler symbols are used to show other facts.

Problems in Percentage. 26 frames. Color, \$3.95. EP.

Uses problems in spending class funds, in raising money for charity, and in saving to give an understanding of how percentage is helpful and how interest is computed by banks.

Record of Speeds. 47 frames. B & W, \$2.00. VS.

Provides a pictorial display of the world's records of nearly every type of moving body. Has some value related to the teaching of graphs. Requires interpretation.

Using Percentage. 23 frames. Color, \$3.95. EP.

Gives practice in changing a per cent to a decimal and to a fraction, finding a per cent of a number, finding what per cent one number is of another, and finding a per cent of change.

We Live On a Huge Ball. 52 frames. B & W, \$3.00. PSPC.

Explains the globe and some of the points and lines used for locating places on the surface of the globe. Latitude is emphasized.

What Is Your Shopping Score? 64 frames. Script. B & W, \$4.00; rental, return postage. HFC.

Emphasizes the ways of becoming a skillful shopper through the use of good shopping habits and wise buying techniques.

FILMS FOR ALGEBRA

Algebra in Everyday Life. 10 minutes. B & W, \$45; color, \$90. Educational Collaborator: R. Orin Cornett. Coronet.

Shows how algebra is used in everyday life as well as in specialized fields. Emphasizes three basic algebraic steps: (1) observation, (2) translation, and (3) manipulation and computation.

The Language of Graphs. 15 minutes. B & W, \$62.50; color, \$125. Educational Collaborator: H. C. Christofferson. Coronet.

Gives picture relationships of bar, line, circle, and equation graphs; makes comparisons between them. Some parts are usable in upper grades and junior high school.

Measurement of Electricity. 11 minutes. B & W, \$50; color, \$100. Educational Collaborator: Ira C. Davis. Coronet.

Teaches the fundamental definitions, formulas, and physical concepts involved in the Volt, Ampere, Ohm, and Watt, and demonstrates some of the mathematical relationships. For senior high school science classes.

Pythagorean Theorem. 12 minutes. B & W, \$50; rental, \$2.00. KB.

Stresses its basic importance, presents the historical background, proves the theorem, and gives examples. A detailed discussion of an interesting use of the 3-4-5-triangle by the Egyptians is included. Some parts are usable in upper grades and junior high school.

FILMSTRIPS FOR ALGEBRA

Addition and Subtraction of Signed Numbers. 48 frames. B & W, \$3.25. SVE.

Explains in simple language the basic concepts involved in the addition and subtraction of signed numbers.

The Arithmetic of Algebra. 46 frames. B & W, \$4.00. JHO.

Visualizes variables and quantities. Applies the fundamental processes in factoring.

Atomic Bomb. 73 frames. B & W, \$3.00. VS.

Gives technical treatment in simplified form regarding atoms and molecules; the structure of matter and atomic energy. Has some aspects useful to algebra and geometry. Requires preparation and discussion.

Equations and Formulas. 63 frames. B & W, \$4.00. JHO.

Shows the meaning and solution of simple equations. Projects the multiple uses of formulas and points out transposition. A time saver for formula users.

Exponents and Logarithms. 87 frames. B & W, \$4.00. JHO.

Shows convenience, variety, and usefulness of powerful "little numbers." Visualizes powers and roots and their relationship to fractions and factors. Speeds up arithmetic and logarithms.

Five Keys to Math. 48 frames. B & W, \$4.00. JHO.

Shows how important mathematics is in everyday and industrial life, how much mathematics one should know, and the methods of learning that will help the student develop ingenuity in applying mathematics. Usable in upper grades and junior high school.

Formulas. B & W, \$3.25. SVE.

Simplifies those algebraic concepts which are difficult to understand by beginning algebra students; shows relationship between arithmetic and algebra.

Graph Uses. 53 frames. B & W, \$4.00. JHO.

Pictures the development and use of graphs in everyday activities, emphasizes graphs in their relationship to formulas and equations and as a device for giving the facts at a glance. Some parts usable in upper grades and junior high school.

Grouping Symbols and Order of Operations. 34 frames. B & W, \$5.00. McG-H.

Shows how symbols help make clear the proper order of operations in problem solving.

Introduction to Algebra. 44 frames. B & W, \$3.25. SVE.

Points out the similarities between arithmetic and algebra. Also treats algebra as a language of signs and symbols, many of which are used in arithmetic, thus making transition from arithmetic to algebra an easy one.

Introduction to Equations. 57 frames. B & W, \$3.25. SVE.

Defines an equation, shows how equations are solved and where they are used. Also calls attention to the use of addition, multiplication, subtraction, and division axioms in the solving.

Introduction to Signed Numbers. 43 frames. B & W, \$3.25. SVE.

Illustrates how signed numbers are nothing more than a convenient method of indicating opposite values. Situations from our daily environment relate the whole concept of signed numbers to real life.

Multiplication and Division of Signed Numbers. 49 frames. B & W, \$3.25. SVE.

Explains, by a series of original illustrations, the mathematical concepts involved in the multiplication and division of signed numbers.

Order of Operations. 46 frames. B & W, \$4.00. JHO.

Points out practical uses of the processes studied, emphasizing operations involving choices of basic methods and development of mental resourcefulness. Usable in upper grades and junior high school.

Plotting Graphs. 69 frames. B & W, \$4.00. JHO.

Visualizes the equation and the influence of constants and how they change the picture. Portrays simultaneous equations and their solution.

Positive and Negative Numbers. 60 frames. B & W, \$4.00. JHO.

Develops the visualization of the "well-known positive" and the "helpful negative" and their influence upon each other in the four fundamental operations. Tells of the contribution of the realm of the negative to mathematical scope.

Problem Analysis. 45 frames. B & W, \$4.00. JHO.

Shows how to "size up" the problem, survey the information, complete the picture, analyze the results, and indicates how preparation pays dividends.

Radio, Electronic Symbols. 40 frames. B & W, \$2.00. VS.

Shows symbols, abbreviations, and sketches. Has some aspects useful to algebra and geometry. Requires discussion and preparation.

Square Root and Cube Root. 52 frames. B & W, \$4.00. JHO.

Demonstrates application of methods of getting roots. Emphasizes understanding versus memory, where memory is short lived. Some parts usable in upper grades and junior high school.

Systems of Equations. 30 frames. B & W, \$5.00. McG-H.

Demonstrates the various methods employed in solving systems of equations.

Thinking in Symbols. 27 frames. B & W, \$5.00. McG-H.

Thinking in symbols is related to the use of signs and symbols in everyday life. Useful in related classes.

Variables and Co-ordinates. 33 frames. B & W, \$5.00. McG-H.

Emphasizes function, variable and constant, and solves problems of direct and inverse variation graphically.

FILMS FOR GEOMETRY

**Angles.* 10 minutes. B & W, \$50; rental, \$2.00. KB.

Explains the various types of angles and their relationship to each other. Parts are suitable for the upper grades.

**Angles and Arcs in Circles.* 12 minutes. B & W, \$50; rental, \$2.00. KB.

Deals with the measurement of central angles, arcs, inscribed angles, and angles formed by two chords. Theorems and proofs are effectively introduced.

**Chords and Tangents of Circles.* 13 minutes. B & W, \$50; rental, \$2.00. KB.

Deals with the theorem of a perpendicular to a chord within the circle. Discusses many types of tangents in detail.

**The Circle.* 12 minutes. B & W, \$50; rental, \$2.00. KB.

Presents and clarifies such important phases as radii, diameters, chords, tangents, secants, arcs, and angles. Theorem and proofs are introduced.

**Congruent Figures.* 12 minutes. B & W, \$50; rental, \$2.00. KB.

Illustrates the geometric principles of "equal sides and equal angles" and clarifies methods for finding and proving that the angles and sides are equal.

Geometry and You. 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: Harold P. Fawcett. Coronet.

Develops an appreciation for the function of geometry and of its everyday importance; studies such figures as rectangles, triangles, and circles, and such principles as congruence, similarity, and symmetry. May also be used in junior high school.

Geometry In Action. 11 minutes. B & W, \$37.50. LF.

Shows everyday applications of geometric forms: transportation, medicine, manufacturing, agriculture, sports, and the home. Usable in junior high school.

How to Judge Authorities. 10 minutes. B & W, \$45; color, \$90. Educational Collaborator: William G. Brink. Coronet.

Bill encounters a puzzling conflict between statements of "authorities." He considers the "internal evidence" on each authority, the experience from which each speaks, and the evidence of his own experience to reach sound, intelligent decisions. Usable in junior high school.

**Lines and Angles.* 10 minutes. B & W, \$50; rental, \$2.00. KB.

Visualizes the mathematical applications of basic geometry. Illustrates, beginning with the erection of a perpendicular, the relationship of the perpendicular with the ordinary plumb bob, level, and square. Shows how angles are formed and measured, the relationship of angles to each other and to the complete circle.

**Locus.* 12 minutes. B & W, \$50; rental, \$2.00. KB.

Visualizes the entire concept of locus; explains it by a combination of photography, drawings, and the spoken word.

Parallel Lines. 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: Nathan Lazar. JHP.

A geometry motivation film that shows the concept of parallel lines, their prevalence in scenes of machine tools and modern architecture, and specific instances of the application of the laws of parallel lines.

Polygons. 11 minutes. B & W, \$50; rental, \$2.00. KB.

Definition of polygon and ideas of convex and concave are clarified by animation. Inscribed circle and circumscribed circle of a regular polygon described. Detailed description given of "Sum of the Interior Angles Theorem" and "Sum of the Exterior Angles Theorem."

Properties of Triangles. 12 minutes. B & W, \$50; rental \$2.00. KB.

Shows the practical importance of the rigidity of the triangle by comparing the strength of triangles with the strength of the non-rigid figures. Animated treatments of the angle bisectors, perpendicular bisectors, altitudes, and medians theorems follow. Shows the merging of lines and points when triangle becomes equilateral.

Pythagorean Theorem. 11 minutes. B & W, \$50; rental, \$2.00. KB.

Presents the historical background of the theorem and includes a detailed discussion of an interesting use of the 3-4-5 triangle by the Egyptians. The theorem is proved and examples are shown. Usable in junior high school.

**Quadrilaterals.* 12 minutes. B & W, \$50; rental, \$2.00. KB.

Illustrates and explains the chief properties of the important quadrilaterals, such as parallelogram, rectangle, rhombus, square, trapezoid, and trapezium. Usable in junior high school.

Ratio and Proportion. 11 minutes. B & W, \$50; rental, \$2.00. KB.

The relationship between ratio and proportion is clarified through various real-life situations and the theorem of "the product of the means equals the product of the extremes" is covered.

**Similar Triangles.* 12 minutes. B & W, \$50; rental, \$2.00. KB.

Presents similar triangles in a graphic manner. It shows properties of similar triangles and demonstrates the "two angles equal" proposition.

FILMSTRIPS FOR GEOMETRY

Addition and Subtraction in Geometry. 56 frames. B & W, \$4.00. JHO.

Points out the relationship of geometry to basic arithmetic, emphasizing ingenuity versus memory and showing the fundamentals from which theorems are developed.

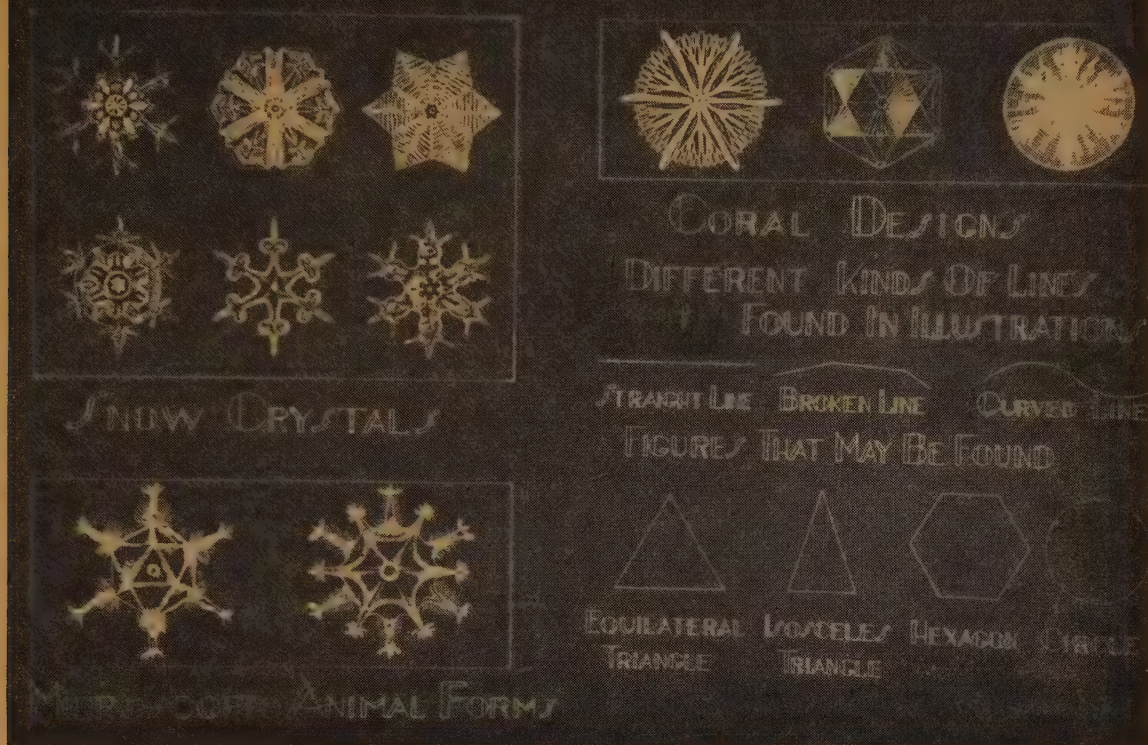
Angular Measurement. 76 frames. B & W, \$4.00. JHO.

Shows relationship of angles to arcs, degrees, radians, mils, and functions.

Applying Geometric Logic; Definition and Key Words. 36 frames. Color, \$4.95. EP.

Shows students that the same type of logical thinking they do in geometry classes can be applied to the thinking that they do in their daily lives, and motivates students to a more meaningful study of the scientific method, both in and out of geometry classes.

GEOMETRICAL DESIGNS IN NATURE



Photograph by Paul E. Harrison

Applying Geometric Logic — Deductive Reasoning. 22 frames. Color, \$4.95. EP.

Continues study of logic as started in filmstrip, *Applying Geometric Logic*.

Applying Geometric Logic — Induction, Analysis, and Indirect Reasoning. 45 frames. Color, \$4.95. EP.

Continuation of filmstrip, *Applying Geometric Logic — Deductive Reasoning*.

Applying Geometric Logic — Mistakes in Thinking. 29 frames. Color, \$4.95. EP.

Covers incorrect generalizations, preconceived judgment, and prejudiced conclusions.

Basic Angles and Experimental Geometry. 56 frames. B & W, \$3.25. SVE.

Explains meaning of a degree and different parts of an angle, classifies angles according to size and position with illustrative material differentiating between different kinds of angles.

Basic Triangles. 47 frames. B & W, \$3.25. SVE.

Classifies triangles according to sides and angles. Uses diagrams to point out features characteristic of each type.

Common Tangents and Tangent Circles. 43 frames. B & W, \$3.25. SVE.

Characterizes common tangents and tangent circles; shows uses in modern industry.

Congruent and Overlapping Triangles. 48 frames. B & W, \$3.25. SVE.

Develops, with diagrams and photographs, meaning of congruent triangles, where they are used, when congruency exists, what overlapping triangles are, and practical applications.

Constructions. 62 frames. B & W, \$4.00. JHO.

Develops geometrical constructions and their relation to problem solution, emphasizing reproductive and creative uses of construction principles. Usable in junior high school.

Foundations of Geometry — Postulates — Lines. 54 frames. Color, \$3.95. EP.

Illustrates importance of postulates, examines 14 basic postulates with their everyday applications and establishes the reason for their acceptance without proof.

Foundations of Geometry — Postulates; Triangles and Circles. 32 frames. Color, \$3.95. EP.

Continues study of the importance of postulates in respect to triangles and circles.

Geometric Figures. 29 frames. B & W, \$5.00. McG-H.

Derives some of the geometric concepts from a carpenter's square, a wheel, and from the cylinders and pistons of a gasoline engine.

Geometry in Art. 53 frames. Color, \$3.95. EP.

Broadens the student's appreciation of geometry by showing its relationship to art and architecture, and illustrates the use in art of geometric patterns for certain formal effects.

Indirect Measurement. 38 frames. B & W, \$5.00. McG-H.

Relates the use of scale drawing to such practical work as surveying, and the help that trigonometry gives in doing some problems.

Introduction to Circles. 49 frames. B & W, \$3.25. SVE.

Shows various lines related to circle: circumference, diameter, radius, arc, chord, semi-circle, and tangent. Focuses attention on use of circular objects in modern trade and industry.

Introduction to Demonstrative Geometry. 48 frames. B & W, \$3.25. SVE.

Explains, with original diagrams, the axioms and postulates upon which demonstrative geometry is based; proves a simple theorem by using postulates and axioms as well as the hypothesis.

Introduction to Plane Geometry. 50 frames. B & W, \$3.25. SVE.

Points out the need for a thorough knowledge of geometry by surveyors, architects, draftsmen, engineers, and carpenters; also shows the meaning and relationship between points, straight lines, curved lines, broken lines, a vertex, the terminal side, the initial side, and an angle.

Introduction to Plane Geometry. 40 frames. Color, \$4.95. EP.

Provides a bridge between past arithmetic and future geometry, arouses curiosity about new concepts without making them complicated, explains general scope of plane geometry.

Loci. 50 frames. B & W, \$3.25. SVE.

An explanation of loci is carried out by means of diagrams and pictures which call attention to the characteristics of loci, where they are found, and how used. Such common loci as the circle, ellipse, parabola, and perpendicular bisector are illustrated.

Locus. 54 frames. Color, \$4.95. EP.

Explains the concept of locus, and assists the student in stating the correct locus theorems.

Mathematics in Aviation: The Compass. 32 frames. B & W, \$5.00. McG-H.

Develops the importance of the knowledge and use of the compass to the aviator when flying by charts only.

Mathematics in Aviation: Wind Drift. 36 frames. B & W, \$5.00. McG-H.

Makes use of the geometry involved in plotting a course and the importance of vector methods to navigators and pilots.

Mathematics in Daily Living. 28 frames. B & W, \$5.00. McG-H.

Makes use of the practical applications of mathematics in the home, in business, and in the community.

Mathematics and the Pilot. 47 frames. B & W, \$4.00. JHO.

Shows that mathematics is important to a pilot who must be able to reckon fast and accurately, and that his mathematical ability is of significance to other members of the crew.

Measurement. 36 frames. B & W, \$5.00. McG-H.

Emphasis on understanding that there are degrees of accuracy.

Multiplication and Division in Geometry. 54 frames. B & W, \$4.00. JHO.

Completes the application of arithmetic to geometry, emphasizing areas and volumes, ratios and similarity, and the circle. Usable in upper grades and junior high school.

Optical Illusions. 36 frames. B & W, \$2.00. VS.

Shows a collection of optical oddities, some of which may be used to demonstrate the need of proof. Can also be used in science, art, and psychology classes. Requires discussion.

Parallel Lines and Transversals. 46 frames. B & W, \$3.25. SVE.

Develops, by a series of original diagrams and photographs, the meaning of parallel lines. Focuses attention on the different pairs of angles and the use of parallel lines and transversals in the modern world in such activities as city planning, surveying, and road construction.

Quadrilaterals. 56 frames. B & W, \$3.25. SVE.

Points out the similarities and differences between such quadrilaterals as the parallelogram, rhombus, square, rectangle, trapezoid, and isosceles trapezoid.

Ratio and Proportion. 50 frames. B & W, \$4.00. JHO.

Develops graphic visualizations of what is meant by ratio and proportion and shows their usefulness in practical, everyday situations. Tells of the Magic Three. Also usable in algebra.

Scales and Models. 83 frames. B & W, \$4.00. JHO.

Tells story behind scales and models by bringing "too big" and "too small" into easy focus. Shows how to plan, use, and understand these valuable aids. Usable in junior high school.

Similar Polygons. 45 frames. B & W, \$3.25. SVE.

The characteristics of various similar polygons are pointed out by a series of original illustrations. The use of similar polygons in drawing maps, floor plans, and in vocations such as surveying is stressed.

Trigonometry. 45 frames. B & W, \$4.00. JHO.

Extends scope of geometry by development of basic relationships and general triangle.

Vectors. 55 frames. B & W, \$4.00. JHO.

Points out a simple means for graphic visualization of the three force properties, analyzes concurrent and resultant forces, simplifies navigation by vectors. Usable in navigation classes.

Vocabulary, Circles I. 30 frames. Color, \$4.95. EP.

Illustrates, defines, classifies circles, including a study of center, circumference, radius, diameter, tangents, secants, chords, arcs, and segments.

Vocabulary, Circles II. 20 frames. Color, \$4.95. EP.

Continuation of *Vocabulary, Circles I* filmstrip.

Vocabulary, Lines and Angles I. 46 frames. Color, \$4.95. EP.

Illustrates common basic new terms of lines and angles; also summarizes the meaning of a collection of terms after they have been studied individually.

Vocabulary, Lines and Angles II. 46 frames. Color, \$4.95. EP.

Continues the study of lines and angles and their relationships.

Vocabulary, Lines, Relationships — Direction, Perpendicular Lines. 20 frames. Color, \$4.95. EP.

Continues explanation and illustration with relationship demonstrated.

Vocabulary, Polygons. 53 frames. Color, \$4.95. EP.

Illustrates, defines, and classifies polygons.

Vocabulary, Triangles. 37 frames. Color, \$4.95. EP.

Illustrates, explains, and classifies triangles. Suitable for junior high school.

FILMS ON MEASUREMENT

The Dial Indicator and Dial Indicator Gages. 38 minutes. Color, \$227.40; rental, one-time showing, return transportation. FPC.

Shows in complete detail the principles of direct and of precision measurement, and explains the meaning of tolerances, accuracy of measurement, sensitivity, and accuracy of repetition. The second part of the film shows how dial indicator gages are used to control the dimensions of interchangeable work-pieces produced by mass production methods. Scenes are taken from the most modern shops where this kind of work is carried on. Suitable for junior and senior high school classes.

Fixed Gages. 17 minutes. B & W, \$34.30. UWF-G.

Presents a demonstration of the use of snap, plug, ring, thread, screw-plug, and flush-pin gages, emphasizing their importance in modern mass production. Their accuracy is stressed.

Height Gages and Test Indicators. 12 minutes. B & W, \$27.46. UWF-G.

Shows the fundamental principles of the vernier height gage, together with various forms of standard indicators, and demonstrates their use.

Latitude and Longitude. 22 minutes. B & W, \$45. UWF-G.

Presents a vivid explanation of latitude and longitude with animation, achieving the illusion of a three-dimensional effect. Suitable for junior high school.

Measurement with Light Waves. OE 174. 15 minutes. B & W, \$32.58. UWF-G.

Explains the principles of measurement with light waves, the nature of light waves, the cause of interference bands, the use of these bands in ultra-precision measurement. Demonstrates procedure in gage block inspection.

The Micrometer. 15 minutes. B & W, \$32.58. UWF-G.

Shows the various forms of the micrometer, the correct reading of the barrel and thimble scales, and emphasizes their correct use and care.

Precisely So. 20 minutes. B & W, rental at express charges. GMC.

Shows the development of modern standards of accuracy from ancient times.

The Steel Rule. 14 minutes. B & W, \$30.85. UWF-G.

Shows how to read steel rules and explains the fractional graduations, how to use the flexible hook and rule-type depth gages and combination squares, how to lay out holes with a combination square, and how to use inside and outside calipers to transfer dimensions.

Verniers. 10 minutes. B & W, \$36.89. UWF-G.

Detailed study, largely in animations, of the principle of the vernier scale and its application to precision measuring instruments.

FILMSTRIPS ON MEASUREMENT

Bright Future. 26 minutes. Color, return postage. Prepared for the General Electric Company. Available through MTPS.

Explains light conditioning and gives scientific formulas for correct lighting for different fixtures and for different rooms.

Fine Cameras, and How They Are Made. 28 minutes. Color, return postage. Prepared for Argus Cameras, Inc. Available through MTPS.

Instructive inside-view of the research, engineering, and craftsmanship behind 35mm cameras and lenses, with diagrammatic explanation of optical principles.

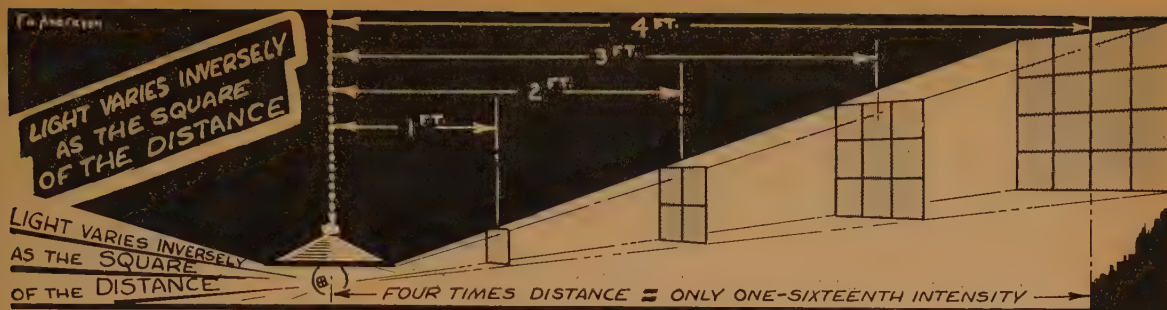
*History of Area Measure.*³ 31 frames. B & W, \$3.50. YAF.

Explains the acre as a unit of land measure and earlier units of area measurement; relates the evolution of modern units of area measure to the development of multiplication.

*History of Linear Measure.*³ 36 frames. B & W, \$3.50. YAF.

Describes the early units of linear measure and shows the evolution of such units as the inch, foot, yard, and rod.

³Usable in intermediate and upper grades and in junior high school



*History of Our Calendar.*⁸ 35 frames. B & W, \$3.50. YAF.

Exhibits man's earliest efforts to devise an accurate calendar and shows how we acquired the names for our months and days.

*History of Our Number System.*⁸ 35 frames. B & W, \$3.50. YAF.

Portrays the history of our number system and counting, early number systems, and the development of the Hindu-Arabic number system.

*History of Telling Time.*⁸ 38 frames. B & W, \$3.50. YAF.

Traces man's efforts to build time-keeping devices from earliest times and shows the evolution of the modern clock.

*History of Weight and Volume Measure.*⁸ 36 frames. B & W, \$3.50. YAF.

Develops the story of early measures of weight and volume and shows how we got the units of measure we have today.

Mechanical Movements. 37 frames. B & W, \$2.00. VS.

Shows principles involved in transmitting various types of motion. Requires teacher aid.

Timekeepers. 39 frames. B & W, \$2.00. VS.

Pictures the evolution of clocks and watches. Requires teacher preparation and discussion.

FILMS ON MECHANICS

Airplane Structures: Structural Units, Materials, and Loads for which Designed. TF 1-211. 8 minutes. B & W, \$12.61. UWF-G.

Describes structural units of the airplane and positive and negative loads each must withstand.

Archimedes' Principle. 6 minutes. B & W, \$25. Educational Collaborator: O. W. Eshbach. EBF.

Explains the law that governs the flotation of bodies in water and in other fluids and includes the historical aspects of its original development. Although intended for science and physics classes it should prove interesting to classes in mathematics.

An Introduction to Vectors — Coplanar Concurrent Forces. OE 361. 22 minutes. B & W, \$41.17. UWF-G.

Explains meaning of scalar and vector quantities, various methods of vector composition and vector resolution, and how vectors may be employed to solve engineering problems.

Principles of Dry Friction. OE 365. 17 minutes. B & W, \$35.15. UWF-G.

Explains the advantages and disadvantages, forces involved, and calculation of the coefficients.

Principles of Gearing. OE 363. 18 minutes. B & W, \$36.89. UWF-G.

Explains and differentiates friction gears and toothed gears. Some mathematics is used.

Principle of Moments. OE 362. 23 minutes. B & W, \$42.19. UWF-G.

Explains the concept of moment of a force and the formula for finding its numerical value; also the principle of moment as applied to all coplanar force systems.

FILMS ON NAVIGATION

Celestial Navigation: Bearing, Single Line of Position and Fixes. TF 1-544. 19 minutes. B & W, \$30.83. UWF-G.

Defines bearing, line of position, circle of equal altitude, fix and intercept, plotting of assumed position and intercept.

Celestial Navigation: Charts. MN 83b. 18 minutes. B & W, \$29.11. UWF-G.

Employs animated diagrams and some straight photography to explain the meaning, advantages, and limitations of Mercator, gnomonic, and Lambert conformal projections.

Celestial Navigation: Introduction and Location of Celestial Points. TF 1-290. 18 minutes. B & W, \$29.11. UWF-G.

Provides an introduction to celestial navigation; illustrates the relation between earth, solar system, and celestial sphere.

Celestial Navigation: Latitude By Polaris. TF 1-545. 10 minutes. B & W, \$15.82. UWF-G.

Shows relationship between latitude and an elevated pole, position and diurnal path of Polaris, and reduction of altitude of an elevated pole.

Celestial Navigation: Nautical Astronomy. MN 83c. 24 minutes. B & W, \$35.29. UWF-G.

Animation is used to show how the celestial co-ordinates are placed in relation to the earth. Describes declination, zenith point, nadir line, and the June and September solstices.

Celestial Navigation: Position Finding on the Earth. TF 1-204. 15 minutes. B & W, \$24.82. UWF-G.

Discusses geographical position, also Greenwich hour angle, local hour angle, relationship of hour angle to longitude, zenith distance and its relation to altitude, circle of position, line of position, fix, relation of assumed to actual position, and intercept.

Celestial Navigation: Solution of Illustrative Problems in Celestial Navigation. TF 1-550. 32 minutes. B & W, \$46.46. UWF-G.

Illustrates preflight computations and flight procedure in making a typical celestial navigation flight. Shows use of the sextant in shooting stars.

Celestial Navigation: The Earth. MN 83a. 16 minutes. B & W, \$27.40. UWF-G.

Explains the arrangement and meaning of the poles, great circles, parallels, meridians, longitude, latitude, nautical miles, and departure.

Celestial Navigation: Time. TF 1-46. 10 minutes. B & W, \$16.91. UWF-G.

Explains various time elements in celestial navigation used in solving practical exercises.

**Global Concepts in Maps.*² 10 minutes. B & W, \$50; color, \$100. Educational Collaborator: Erwin Raisz. Coronet.

Globe representations, projections, and distortions are concepts developed as understood by our air age. A demonstration of great circle routes on a polar projection gives a summary of practical uses of the cylindrical, conic, and perspective projections.

*The Impossible Map.*² 10 minutes. Color, \$75; rental, \$2.50 per day plus transportation charges. NFB.

Illustrates the difficulty of presenting a true picture of the world on a flat surface. The film properly brings out the distortions that occur when any but a nearly spherical surface is used, thus indicating that globe is best medium for presenting an accurate picture of the earth.

Navigation — Star Identification. MN 83f. 16 minutes. B & W, \$27.40. UWF-G.

Discusses apparent movement of stars across sky; locates and identifies 23 basic navigation stars.

Navigation — Time. MN 83e. 56 minutes. B & W, \$81. UWF-G.

Divides the globe into time zones; divides time into apparent, sidereal, and mean time; illustrates use of chronometer.

FILMS ON HIGHER MATHEMATICS

Engineering. 11 minutes. B & W, rental, \$1.75. University of Wisconsin.

Presents the fields of civil, mechanical, structural, hydraulic, sanitary, combustion, machine design, refrigeration, heating, and ventilating engineering. Qualifications and duties of engineers in each of the above fields are listed.

Indirect Measurement. 11 minutes. B & W, \$50; rental, \$2.00. KB.

Shows the need for indirect measurement techniques by giving specific situations where direct measurements can not be made. Demonstrates three methods of indirect measurement: congruent triangles, similar triangles, and trigonometry.

**Periodic Functions. X-M-109.* 17 minutes. B & W, \$28.10. UWF-G.

Explains through demonstration the meaning of a sine wave and develops the idea of the periodic function; shows that the voltage of an alternating current is a sine wave.

**Rectilinear Coordinates.* 10 minutes. B & W, \$40; rental, \$2.00. KB.

Shows how a point moves and becomes a line. Explains positive and negative numbers from co-ordinate positions; branches out into tri-dimensional areas.

**The Slide Rule I. (C and D Scales.)* 24 minutes. B & W, \$43.07. UWF-G.

Explains in detail the "C" and "D" scales of the slide rule, and how to use these scales for multiplication, division, and combinations of these two operations. Usable in junior and senior high school classes.

**The Slide Rule II. (A and B Scales.)* 21 minutes. B & W, \$39.44. UWF-G.

Shows how to use the "A" and "B" scales of the slide rule to calculate proportions and percentages; how to calculate squares and square roots; and the placing of decimals after the square root is extracted. Usable in junior and senior high school classes.

FILMSTRIPS ON HIGHER MATHEMATICS

Analytic Geometry. 44 frames. B & W, \$4.00. JHO.

Visualizes the writing of quadratic equations for easy graphing. Uses drawing board methods in graphing. Parts usable in algebra classes.

Areas by Integration Using Polar Coordinates. 36 frames. B & W, \$4.00. Educational Collaborator: E. A. Whitman. SVE.

Explains via diagrams the mathematical concepts involved in computing areas bounded by curves whose equations are given in polar co-ordinates.

Areas by Integration. 38 frames. B & W, \$4.00. Educational Collaborator: E. A. Whitman. SVE.

Shows, by a series of diagrams, how the single integral is used to compute the area bounded by a straight line and a curved line, as well as the area bounded by two curved lines.

Double Integrals. 45 frames. B & W, \$4.00. Educational Collaborator: E. A. Whitman. SVE.

Utilizes a series of easy to understand diagrams as a means of showing how the double integral is used in determining the area between two curved lines and between a curved line and a straight line.

The Slide Rule: Part I. 24 frames. B & W, \$5.00. McG-H.

Presents multiplication and division.

The Slide Rule: Part II. 27 frames. B & W, \$5.00. McG-H.

Demonstrates proportion and square root and solves some additional problems.

A Triple Integral. 53 frames. B & W, \$4.00. Educational Collaborator: E. A. Whitman. SVE.

Visualizes, with a series of original illustrations, the often hard to understand concept of using the triple integral in finding the volume of solids, bounded by curved surfaces.

REFERENCES

"Aids to Teaching." *The Mathematics Teacher.* XLI (1948)-XLVI (1953). By Henry W. Syer and Donovan A. Johnson.

Gives detailed descriptions and appraisals of booklets, charts, equipment, films, filmstrips, instruments, models, pictures, plans for construction, and sources of material for laboratory work; covers more than 200 pages to date. Excellent.

"A Bibliography of Mathematics Films and Filmstrips." *School Science and Mathematics*. XLIX: 8, pp. 650-657, November, 1949. By Donovan A. Johnson and Henry W. Syer.

Lists, without description or appraisal, 116 films and 151 filmstrips together with the names of the producers; names and addresses of the producers are in a separate category.

Bibliography of Mathematical Motion Picture Films, Filmstrips, Slides, and Stereographs. By Perry A. Chapdelaine, 414 First Street, Mason City, Iowa. 1949. 75c plus postage.

Contains 35 pages of titles, classifications, and descriptions; also names and addresses of 73 producers, distributors, and audio visual aids services.

Mathematics — Visual and Teaching Aids. By Lili Heimers *et al*, New Jersey State Teachers College, Upper Montclair, N. J. 1947. 75c.

Contains 30 pages of lists of charts, maps, devices, exhibits, films, slides, filmstrips, games, pictures, publications, and recordings, together with cost and where obtainable.

Educational Film Guide and Filmstrip Guide, Eleventh Edition. H. W. Wilson Company, 950 University Avenue, New York, N. Y., 1953. 1,000 pp. Prices vary according to choice of service selected.

The film guide contains a list of more than 11,000 16 mm films on numerous subjects, indexed and described. It is considered a good reference. The filmstrip guide provides lists of filmstrips, with descriptions, on numerous subjects. Both guides are brought up to date; supplements are provided between issues.

DIRECTORY — FILMS AND FILMSTRIPS

Bailey	Bailey Films, Inc.	6509 DeLongpre Avenue	Hollywood 28, California
Brandon	Brandon Films, Inc.	200 W. 57th Street	New York 19, New York
CINB	Continental Illinois National Bank	Film Department 231 S. LaSalle Street	Chicago 4, Illinois
Coronet	Coronet Instructional Films	65 E. South Water Street	Chicago 1, Illinois
EBF	Encyclopedia Britannica Films, Inc.	1150 Wilmette Avenue	Wilmette, Illinois
EP	Educational Projections, Inc.	10 E. 40th Street	New York 16, New York
EGH	Eye Gate House, Inc.	2716 Forty-first Avenue	Long Island City 1, New York
Films	Films, Inc.	1150 Wilmette Avenue	Wilmette, Illinois
FPC	Federal Products Corporation	1144 Eddy Street	Providence 1, Rhode Island
FF	Firth Films	1816 N. Highland	Hollywood 28, California
GMC	General Motors Corporation, Dept. of Public Relations	Film Section 3044 W. Grand Boulevard	Detroit 2, Michigan
HFC	Household Finance Corporation	919 N. Michigan Avenue	Chicago 11, Illinois
JHO	Jam Handy Organization, Inc.	2821 E. Grand Boulevard	Detroit 11, Michigan
JHP	Johnson-Hunt Productions	6509 DeLongpre Avenue	Hollywood 28, California
KB	Knowledge Builders	Visual Education Building	Floral Park, New York
LF	Library Films, Inc.	25 W. 45th Street	New York 19, New York
McG-H	McGraw-Hill Text-Films	330 W. 42nd Street	New York 18, New York
MTPS	Modern Talking Picture Service, Inc.	45 Rockefeller Plaza	New York 20, New York
NFB	National Film Board of Canada	1270 Avenue of the Americas	New York 20, New York
OSU	The Ohio State University	Teaching Aids Laboratory, 13 Page Hall	Columbus 10, Ohio
PSPC	Popular Science Publishing Company	Audio-Visual Division, 353 Fourth Avenue	New York 10, New York
SVE	Society for Visual Education, Inc.	1345 W. Diversey Parkway	Chicago 14, Illinois
UWF-G	United World Films, Inc.,	Government Films Department 1445 Park Avenue	New York 29, New York
VS	Visual Sciences	Box 599-HW	Suffern, New York
Wayne	Wayne University	Audio-Visual Materials Bureau	Detroit 1, Michigan
YAF	Young America Films, Inc.	18 E. 41st Street	New York 17, New York

SOME FILM RENTAL SOURCES

Write to the nearest source concerning availability of the films you desire, the rates, and the service regulations. Book well in advance of needs.

ALABAMA:	A-V Aids Service	University of Alabama	University
ARIZONA:	Extension Division	University of Arizona	Tucson
ARKANSAS:	A-V Service	State Department of Education	Little Rock
CALIFORNIA:	Extension Division	University of California	Berkeley or Los Angeles
COLORADO:	Extension Division	University of Colorado	Boulder
CONNECTICUT:	Pix Film Service	34 E. Putnam	Greenwich
FLORIDA:	Department of Visual Instruction General Extension Division	University of Florida	Gainesville
	A-V Service	Florida State University	Tallahassee
GEORGIA:	Extension Division	University of Georgia	Athens
IDAHO:	Film Library	State College	Pocatello
ILLINOIS:	A-V Aids Service	Southern Illinois University	Carbondale
	Visual Aids Service	University of Illinois	Champaign
INDIANA:	A-V Center	Indiana University	Bloomington
IOWA:	Extension Division	University of Iowa	Iowa City
KANSAS:	Extension Division	University of Kansas	Lawrence
KENTUCKY:	Department of Extension	University of Kentucky	Lexington
LOUISIANA:	Ideal Pictures	3374 Nicholson Drive	Baton Rouge
MARYLAND:	Kunz Motion Picture Service	426 N. Calvert	Baltimore
MASSACHUSETTS:	Visual Aids Service	Boston University	Boston
MICHIGAN:	Extension Service	University of Michigan	Ann Arbor
MINNESOTA:	Extension Service	University of Minnesota	Minneapolis
MISSISSIPPI:	School of Education	University of Mississippi	University
MISSOURI:	Extension Division	University of Missouri	Columbia
MONTANA:	Department of Visual Education	State Department of Education	Helena
NEBRASKA:	Extension Division	University of Nebraska	Lincoln
NEW JERSEY:	Film Library	State Museum	Trenton
NEW YORK:	Education Film Library	Syracuse University	Syracuse
NORTH CAROLINA:	Extension Division	University of North Carolina	Chapel Hill
NORTH DAKOTA:	Division of Supervised Study	Agricultural College	Fargo
OHIO:	Slide and Film Exchange	State Department of Education	Columbus
OKLAHOMA:	Extension Division	University of Oklahoma	Norman
OREGON:	Visual Instruction Service	State College	Corvallis
PENNSYLVANIA:	J. P. Lilley and Son	277 Boas	Harrisburg
SOUTH CAROLINA:	Extension Division	University of South Carolina	Columbia
SOUTH DAKOTA:	Taylor Films	79 Third Street	South East Huron
TENNESSEE:	Extension Division	University of Tennessee	Knoxville
TEXAS:	Department of Visual Education	State Department of Education	Austin
UTAH:	Bureau of A-V Education	University of Utah	Salt Lake City
VIRGINIA:	Ideal Pictures	219 E. Main	Richmond 19
WASHINGTON:	Department of Visual Education	College of Education	Ellensburg
WEST VIRGINIA:	Pavis Electronic and Supply Co.	P. O. Box 6095	Charleston 2
WISCONSIN:	Extension Division	University of Wisconsin	Madison

FREE AND INEXPENSIVE AIDS FOR MATHEMATICS TEACHING

The materials listed and described in this section were gathered and evaluated by Marie Brennecke, Washington High School, East Chicago, Indiana; Marion Eckel, Kelly High School, Chicago; Frances Goen, Central Evening High School, Newark, New Jersey; Mildred Harms, Kelvyn Park High School, Chicago; Mary Peters, Elgin High School, Elgin, Illinois; Mabel Scheible and Virginia Terhune, Chairman, Proviso Township High School, Maywood, Illinois.

Andre, Richard, Dept. of Mathematics, University of Oklahoma, Norman, Oklahoma.

O. U. Mathematics Letter. Single copies available free to high school teachers. Contains very interesting topics for the mathematics teacher and the high school student. Students will enjoy the problem quiz, since they are urged to submit their solutions.

Association of American Railroads, Transportation Bldg., Washington 6, D. C.

A Review of Railway Operations in 1952. Single copies available free to teachers. Contains information that can be used in a unit on transportation on a junior high school level. Includes such topics as employment and wages, rates and fares, etcetera.

Railroad Transportation. A Statistical Record 1911-1951. Single copies available free to teachers. Contains some clear, large, broken line graphs and many statistical tables.

The Railroad Story. Available in quantity; free. An interesting story of the scientific development of the railroads. The few graphs in the booklet can be used to show how quickly a graph can tell a story.

A Year Book of Railroad Information, 1953 Edition. Available in quantity; free. A booklet of tables and bar graphs. Can be used as visual material in a unit on graphs.

Railroad Facts, 1953 Edition. Available in quantity; free. Same type booklet as the year-book described above.

Bonded Scale and Machine Company, 2190 S. Third St., Columbus, Ohio.

Original Investigation, or How to Attack an Exercise in Geometry. Free only to teachers of mathematics at high school and college level.

Boyer, Lee E., Millersville State Teachers College, Millersville, Pa.

Mathematics in the Planning of a Modern Watch. 25c. A ten-page report by G. W. Sauerwald, Hamilton Watch Company. This is Report No. 1 of the Pennsylvania Council of Teachers of Mathematics.

Central Association of Science and Mathematics Teachers, Ray C. Soliday, Treasurer, P. O. Box 408, Oak Park, Ill.

The following reprints from *School Science and Mathematics* are available:

Mock Trial of B Versus A. Adapted by Kathryn McCorley from Stephen Leacock's essay on A, B, and C. 30c.

Mathematics Problems from Atomic Science. By Hyman Ruchles. 25c.

The Mathematics of Gambling. By Ernest Blanche. 25c.

100 Topics in Mathematics for Programs or Recreation. 25c.

Computation with Approximate Numbers. By W. A. Gager. 17 pp. 25c.

Payment for any of the above must accompany order.

Chase National Bank Museum of Moneys of the World, 13 Broad St., New York 15, N. Y.

Moneys of the World. 24 pp. Single copies available free to teachers. Describes ancient and modern forms of money.

Chicago Bar Association, 29 S. LaSalle St., Chicago 3, Ill.

When You Buy On Time. Contains very important information that can be used in a unit on installment buying. Includes such topics as conditional sale contract, promissory note, wage assignment, etcetera.

So You're Going To Buy a Home. Important information on some of the legal problems involved in real estate. Good background material for the teacher.

These two pamphlets are based on Illinois law and may not apply to other states. Free to schools.

Christman, Laura E., 1217 Elmdale Ave., Chicago 40, Ill.

A Rhythmic Approach to Mathematics. 68 pp. 50c. Edith Somervall describes methods of inventing designs for sewing cards and for evoking the geometric instinct. Mathematical curves and figures are developed through use of yarn, cardboard, and straight stitches.

Boole Curve Sewing Cards — with directions. 20c per set; 25 or more, 15c per set.

Chart: Mathematics Calendar 4000 B. C.-1917 A. D. 65c. Outlines and illustrates the important epochs of mathematics.

Denoyer-Geppert Company, 5235 Ravenswood Ave., Chicago 40, Ill.

Globes in plain slated black finish — 6", 8", 12", 16", and 20". See company catalog for prices.

Slated cloth graph chart with 1" squares. \$11 and \$13.25.

Galileo. A picture 26"x35", suitable for framing, \$1.50.

Mathematical Geography Desk Maps. For the study of scales. 11"x16". 5c each; 50 or more, 3c each. Sample free on request.

Dun and Bradstreet, Inc., Public Relations and Advertising, New York, N. Y.

Charts of various kinds available on request. Good for bulletin board material in teaching graphs in junior and senior high schools.

Educational Research Bureau, 1217 Thirteenth St., N. W., Washington 5, D. C.

Banking System in the United States. By Harriet Heald. 5c. A brief description of the various kinds of banking institutions and their methods and purposes.

Mathematical Puzzles. By Harriet Heald. 30 pp. 15c.

Bulletins — 5c. Size 7" x 8", 4 to 6 pp.:

Coins — History of Designs on United States Coins.

Coins — values and descriptions of rare American coins.

Stock Exchange and New York Curb Market — history; how they are operated and regulated.

Sundials — how to make them.

Measurements, Household — systems of weights and measures in everyday use.

Story of the Calendar — a brief history of the ways devised by man for the measurement of time.

Perpetual Ready Reference Calendar.

Florida Bankers Association, Orlando, Fla.

Banks — What They Mean To Us. Prepared co-operatively by representatives of the Florida Bankers Association and the Florida Teachers of Mathematics. 64 pp. Includes services of banks, how to use these services, and suggestions for classroom activities. Very good for background material for general mathematics classes. \$1.00 copy; reduction for quantity lots. Suggest that teachers contact their local bankers for copies.

Ford Motor Company, Education Relations, Dearborn, Mich.

How Long Is a Rod? Free. An historical review of the measurement of length. Illustrated. Some schools have had large copies made in color for classrooms.

Gehman, H. M., Mathematical Association of America, University of Buffalo, Buffalo 14, N. Y.

Professional Opportunities in Mathematics. Reprint from *American Mathematical Monthly*, January, 1951. 25c single copy; 10c each for 10 or more. Discusses careers in teaching, in applied statistics, in the industrial laboratory, in government, in the actuarial professions, and others. Selected references given.

General Electric Company, Public Relations Services Division, 1 River Rd., Schenectady 5, N. Y.

Why Study Math? 8 pp. Free. Designed to stimulate interest in mathematics. Well written and illustrated.

Math at General Electric. 15 pp. Free. Samples of the varied types of problems needing solution in the different phases of work at G. E. Illustrated.

Motion Pictures and Slide Films. Free. A listing of films available through G. E. film libraries.

- General Motors Corporation, Dept. of Public Relations, Educational Service, Detroit 2, Mich.
Precision — A Measure of Progress. 64 pp. Limited supply available to teachers free upon request on their school stationery. Interesting non-technical history from early measurement to precision use of electronic gauge.
General Motors Film Library, Fourteenth Edition. Lists 50 available subjects. Film users pay return postage only.
- Good Reading Rack Service, 76 Ninth Ave., New York 11, N. Y.
Nine Ways to Borrow \$1000. A reprint of chart from *Pageant* magazine article. Explains some basic ideas in methods of borrowing money. Shows the differences between lump sum payments and periodical payments. Good information for a business mathematics class. Single copies 15c; 2 to 99: 8c plus $\frac{1}{2}$ c per copy for shipping charges; 100 to 1000: 7c, plus $\frac{1}{2}$ c per copy; 1000 to 10,000: 6c plus $\frac{1}{2}$ c per copy.
- Gude, A. J., Box 374, Golden, Colo.
 Construction Kit for Three-Dimension Models of the Basic Crystallographic Forms. 41 plates on heavy paper, 111 models, \$3.50; 20 per cent discount on 10 or more. Sheet of instructions for cutting, folding, pasting, and coloring. Meets requirements of crystallographers, mineralogists, chemists, geometricians, science teachers, and others.
- D. C. Heath and Company, 1815 S. Prairie Ave., Chicago, Ill.
 An Arithmetic Crossnumber Puzzle. Free.
- Household Finance Corporation, Consumer Education Dept., 919 N. Michigan Ave., Chicago 11, Ill.
Money Management Library. The following booklets available in practical library box for \$1.00; separately, 10c each: *Your Budget*; *Children's Spending*; *Your Health Dollar*; *Your Food Dollar*; *Your Clothing Dollar*; *Your Shelter Dollar*; *Your Home Furnishings Dollar*; *Your Equipment Dollar*; *Your Recreation Dollar*; *Your Shopping Dollar*; *Consumer Credit Facts for You*.
College Budget Calendar. Free. Workbook for college students to budget educational and living expenses.
Small Loan Laws of the United States — a publication of Bureau of Business Research, Western Reserve University. Free.
 Filmstrips, with script to be read as pictures are projected, are available on various topics concerned with budgeting and buying. Free loan for one week.
- Institute of Life Insurance, Educational Division, 488 Madison Ave., New York 22, N. Y.
Blue Print for Tomorrow. 23 pp. Free in quantity. Contains 8 lessons on questions concerning life insurance and a project on applying for a life insurance policy. Excellent for unit in general mathematics.
Graphic Facts — colorful graph charts, 8½"x11", suitable for bulletin board.
The Search for Security. Free.
What's In Your Life Insurance Policy? Free.
What Will Social Security Do For Me? Free.
The Story of Life Insurance. Free.
Farm Women Asked Us. Free.
A Date With Your Future. 1 copy free; additional, 10c.
Careers for Youth in Life Insurance. 2 free; additional, 25c.
The Man Who Runs Interference. Free.
A Career in Life Insurance Sales and Service. 2 free; additional, 25c.
Handbook of Life Insurance; Study Guide and Work Book. 10c.
Life Insurance Fact Book. 1 free; additional, 25c.
Family Money Manager. Free.
A Discussion of Family Security. 1 free.
History of 10,000 Life Insurance Policy Holders. 25c.
Teaching Aids on Family Security. Free catalog listing above and other teaching aids — booklets, charts, and films.

- Jones, Phillip S., University of Michigan, Dept. of Mathematics, Ann Arbor, Mich.
How High School Mathematics Can Contribute to Your Career. Poster. 5c each; 10 for 25c.
- The Lewis Kohrs Company, 2208 Stuart St., Berkeley 5, Calif.
I'll Bet You Can't. \$1.00; 75c to teachers if cash with order, postpaid. A choice collection of easy challenge tricks by Lewis Kohrs with line drawings by the author.
- Lieberstein, Mel., Dahlgren, Va.
Sets and Logic. 17 pp. 75c each; 65c each in large quantities.
Problem of the Week. \$2.50 set; 3 or more \$6.50. Selection of puzzles and their solutions in form for bulletin board use to stimulate interest in mathematics.
- Lufkin Rule Company, Saginaw, Mich.
The Amazing Story of Measurement. Free. Interesting booklet, in comic book form, on history and growth of precision. Chaldean, Early Egyptian, Greek, and Roman units. History of acceptance of metric system. Copyright 1953.
- Marchant Calculating Machine Company, Education Dept., Oakland 8, Calif.
From Og to Googol. Free. Brief story of the history of numbers. Good supplementary reading materials for all classes.
 School Manual — \$2.00; Teacher's Guide — 25c; Answer Book — 15c. Problems for the calculator; many could be used in mathematics classes.
- National Assn. of Manufacturers, Education Dept., 14 W. 49th St., New York 20, N. Y.
Educational Aids for High Schools. 8 pp. Free. Lists and briefly describes 23 titles available; some are of value in mathematics classes.
- National Council of Teachers of Mathematics, 1201 Sixteenth St., N. W., Washington 6, D. C.
 Set of 15 posters prepared by the Signal Corps showing uses of mathematics in signal corps work.
 Curve Unit. 75c each; 3 for \$1.00.
- Navy Dept., Bureau of Naval Personnel, Washington 25. D. C.
Regulations Governing the Admission of Candidates Into the United States Naval Academy as Midshipmen and Sample Examination Questions. 64 pp. Free.
- New York Stock Exchange, Public Relations Dept., 20 Broad St., New York, N. Y.
The Nation's Market Place. Free leaflet.
Investment Facts About Common Stocks and Cash Dividends. 17 pp. Free.
Understanding the New York Stock Exchange. 50 pp. Illustrated. Free.
- Public Affairs Pamphlet Series, Public Affairs Committee, 22 E. 38th St., New York 16, N. Y.
How To Buy Life Insurance. Pamphlet No. 62. 25c single copy, reduction for quantity orders. Gives informational background to the teacher.
- Scott, Foresman and Company, 433 E. Erie St., Chicago 11, Ill. Free.
 Wall Charts:
Do You Know These Mathematical Words?
How to Read Large Numbers.
Adding Signed Numbers — With Signed Number Slide Rule.
It Makes Solid Sense. 7 solids appear flattened-out to aid in understanding formulas for areas of surfaces.
- Pamphlets:
Your Mathematics Notebook. Contains information concerning mathematics activities in various schools, articles on mathematics teaching, suggested bibliographies, etcetera.
Without Paper and Pencil. Tips on estimating and computing mentally.
General Mathematics Check List. A check list for evaluating a general mathematics course.
The Number System. 6½"x8½" card with pictures of groups of objects on both sides designed to bring meaning to numbers 12 and 43. 4 page teaching folder shows how to develop understanding of place value.

Exploring a New Approach to Number Learning. Workshop suggestions to use with primary teachers.

Exploring Groups of Five. Transcription of wire-recorded demonstration lesson in first grade teaching the meaning of *five*.

Scripta Mathematica, Yeshiva College, 186th St. at Amsterdam Ave., New York 33, N. Y.

Illustrated Mathematical Postal Cards Series A. Free to schools; 50c to individuals. Portraits of great mathematicians — 10 cards.

Mathematicians — Illustrated Mathematical Postal Cards Series B. Geometrical designs — 4 cards. Free to schools. 20 cards for \$1.00. Additions to Series B — 12 cards for 60c. Excellent for bulletin board.

The Wonderful Wonders of One, Two, Three. By David Eugene Smith. \$1.25.

Poetry of Mathematics and Other Essays. By D. E. Smith. \$1.25. Very good.

On the Beauty of Geometrical Forms. By Robert E. Moritz. 25c. Good for student who wishes to explore beyond his textbook.

Dynamic Geometrical Forms. A series of plates by H. V. Baraballe. 10c per plate.

Mathematical Themes in Design. By Rutherford Boyd. A series of plates at 10c per plate.

Sir Isaac Newton. Free to schools only. 5 different portraits, $6\frac{1}{2}'' \times 9\frac{1}{2}''$, suitable for framing.

Silver Burdett Company, Research Service Dept., 221 E. 20th St., Chicago 16, Ill.

"4 Questions Teachers Ask About Arithmetic," *Resourceful Teacher*, Volume V, Number 2. By Robert Lee Morton. 14 pp. Free. Deals with four types of questions from teachers, which reveal areas in which unsatisfactory results are being obtained. These questions deal with (1) anticipating learning difficulties, (2) evaluation of pupil progress, (3) reteaching, and (4) understanding of the number system, particularly large numbers.

Society for Visual Education, Inc., 1345 Diversey Pkwy., Chicago 14, Ill.

Teaching With the Tachistoscope. 20 pp. Single copies available free to teachers and principals. A manual that contains important information for teachers interested in improving the teaching of the basic arithmetic combinations and facts by flash methods; includes data and recognized groupings.

L. S. Starrett Company, 17 N. Jefferson St., Chicago 6, Ill.

Decimal Equivalent Chart. 35c. Large chart.

Decimal Cards. Small cards. 3c each.

These will be sent postpaid upon request; remittance must accompany request.

Treasury Dept., U. S. Savings Bonds Division, Room 300, 105 W. Adams St., Chicago 3, Ill.

Teaching Thrift through School Savings. Free. A course of study for thrift education, for all grades below the ninth, with United States Savings Stamps and Bonds as the foundation on which to build the practice of thrift.

School Savings in the Social Studies. 32 pp. Free. Part I — Learning How to Use Money Wisely, a study unit for grades 4-7; Part II — Plans for Spending and Saving, a study unit for grades 7-12; Part III — supplementary material for use with both units.

Union Dime Savings Bank, Service Dept., 6th Ave. at 40th St., New York 18, N. Y.

Budget and Expense Record Form. A budget and expense record form set up for the daily expenditures and savings record of the family for a period of three months. This form is not a formal account book. The purpose of the record is to help control current expenditures and serve as a guide to wiser spending and saving in the future. Suitable as supplementary material for a unit on budgeting the family income at the high school level. A copy of the record form is available to teachers requesting it for reference purposes; classroom quantities can not be supplied outside the New York area.

United Air Lines, School and College Service, 35 E. Monroe St., Chicago 3, Ill.

Air Transport Facts and Figures. Free. Useful in teaching unit on graphs.

Modern Flight

Seeing the Airport

Coast to Coast Geography from the Air

Your Future in Air Transportation

List of Free Aviation Education Materials and Services. Includes material for senior and junior high schools and elementary grades.

The History of the Mail

Your Set of Pictures on DC6 Mainliner

Your Set of Pictures on Historic Flights

Air Cargo

United States Dept. of Agriculture, Forestry Service, Washington 25, D. C.

Ranger 'Rithmetic for Sixth Grade Teachers and *Ranger 'Rithmetic for Seventh Grade Teachers.* Free in quantities of no more than 5 to one teacher.

Two booklets, attractively set up, of 21 illustrated problems on topics related to forest conservation.

U. S. Government Printing Office, Division of Public Documents, Washington 25, D. C.

Mathematics in Public High Schools. 47 pp. 25c. Statistics about enrollments in mathematics and administrative provisions for mathematics instruction. May interest teachers only.

Education for the Talented in Mathematics and Science. 34 pp. 15c. Of special interest to the mathematics teacher in guiding the better mathematics students.

The University Prints, 11 Boyd St., Newton 58, Mass.

C-167 — *School of Athens*, Raphael.

C-168 — *School of Athens*, Detail, Raphael.

D-153 — *Portrait of Galileo*, Sustermans.

D-287 — *Portrait of a Mathematician*, Bol.

D-405 — *Melancholy*, Durer.

O-518 — *Automaton: A Candle Clock, From Al-Jazir i MS.*

P- 34 — *The Philosopher*, Rembrandt.

H- 92 — *The Arts and The Sciences*, Cox.

F- 71 — *Lord Newton*, Raeburn.

Prints, 5½"x8", 2½c each; minimum order 50c. Special list of pictures suitable for visual aids in mathematics classes — 20 pictures for 50c.

John Winston Company, 509 S. Wabash Avenue, Chicago 16, Ill.

One Square Yard. A chart which can be used to show the relationship between one square inch, one square foot, and one square yard. The reverse side is an advertisement of the company's arithmetic texts.

Yoder Instrument Company, East Palestine, Ohio.

Computation With Approximate Data. By Carl Shuster. 25c single copy; 20 to 99, 20c each; 100 or more, 17c each.

MATERIAL AVAILABLE FROM U. S. OFFICE OF EDUCATION

KENNETH E. BROWN, SPECIALIST FOR MATHEMATICS

Arithmetic in Elementary Education. No. 13 of Elementary Education Series. 14 pp. Dept. of Health, Education, and Welfare. Free.

Contains references in arithmetic including those related to research, trends, and courses of study.

Education for the Talented in Mathematics and Science. By Kenneth E. Brown and Philip G. Johnson. Bulletin 1952, No. 15. 34 pp. Supt. of Documents. 15c.

Discusses what is being done by leading educators to provide increased facilities and methods for the maximum development of rapid learners in these fields.

Free and Inexpensive Aids for the Teaching of Mathematics. By Kenneth E. Brown. Circular No. 348. 7 pp. Dept. of Health, Education, and Welfare. Free.

Contains sources of free and inexpensive materials for teaching units and for helping the student make his own learning aids.

How Children Use Arithmetic. By Effie G. Bathurst. Bulletin 1951, No. 7. 13 pp. Supt. of Documents. 15c.

Discusses some of the objectives of teaching arithmetic and methods of instruction.

Mathematics Education Research Studies—1952. By Kenneth E. Brown. Circular No. 377. 25 pp. Dept. of Health, Education, and Welfare. Free.

Contains summaries of 57 studies completed in 1952.

Mathematics in Public High Schools. By Kenneth E. Brown. Bulletin 1953, No. 5. 47 pp. Supt. of Documents. 20c.

Contains information on mathematics enrollments in public high schools, typical offerings, size of classes, number of teachers, field trips, length of class periods, and other pertinent facts about mathematics education in grades 7 to 12.

The Outlook for Women in Mathematics and Statistics. Supt. of Documents. 10c.

Pamphlet lists positions available for women in these fields and qualifications needed.

Selected Bibliography of Current Articles in Mathematics Education. By Kenneth E. Brown. Circular No. 346. 6 pp. Dept. of Health, Education, and Welfare. Free.

The selected articles are grouped under Teaching of Algebra, Teaching of Geometry, Teaching of General Mathematics, Motivation for the Study of Mathematics, Curriculum Development in Mathematics, and Recent Books in Mathematics Education.

Selected Bibliography of Reference and Enrichment Material for the Teaching of Mathematics. By Kenneth E. Brown. Circular No. 347. 7 pp. Dept. of Health, Education, and Welfare. Free.

Bibliography of selected books listed under the headings: History of Mathematics, Teaching of Mathematics, and Recreation and Enrichment. The grade level of each book is indicated.

MATERIAL AVAILABLE FROM NCTM

M. H. AHRENDT, EXECUTIVE SECRETARY

Curve Unit No. 139. 75c each or 3 for \$1.50.

A kit containing materials with an explanatory leaflet for forming conic sections by curve stitching, paper folding, string and pencil construction, and cutting a string model of a cone.

Guidance Pamphlet in Mathematics. 25c.

Written especially for the high school student. Tells what mathematics the student needs for success as a citizen and in various vocations. Describes the opportunities available to persons trained in mathematics.

Mathematical Preparation for College. 15c.

Addressed to high school students. Gives the results of recent studies on the high school preparation in mathematics that students will need in order to enter various vocations.

Numbers and Numerals. By David Eugene Smith and J. Ginsburg. 35c.

An illustrated account of the history of numbers. Scholarly, yet easy to read. Contains an interesting section on number puzzles and recreations.

Number Stories of Long Ago. By David Eugene Smith. 75c.

Gives an interesting account in story form of the probable history of numbers. Contains a section on number puzzles. A good seller for many years.

Signal Corps Posters. 40c per set.

Twenty different posters, each 7" x 10¼", showing applications of mathematics in radio and communications. Excellent for bulletin board.

Thinking About Thinking. By C. J. Keyser. 75c.

A classic; in demand for many years. Gives an excellent discussion of logical thinking and its relationship to mathematics.

Tree of Knowledge. Sold in dozen lots only. 30c per dozen.

Shows the relationship of pure and applied science and the basic importance of mathematics to the other fields of knowledge.

JOURNALS

The Arithmetic Teacher. Published October, December, February, and April. First issue published in February 1954. \$1.50 to individuals; \$2.50 to libraries, schools, departments, and other institutions. Additional postage per year: Canada, 10c; foreign, 25c.

A journal devoted to the improvement of the teaching of mathematics in kindergarten and all grades of the elementary school.

Back Numbers of *The Mathematics Teacher.* 50c each.

Many back numbers are available dating from 1940. List available on request.

Binders for *The Mathematics Teacher.* \$2.50 each.

A handsome, durable, library-style binder that will hold eight issues. *Mathematics Teacher* is stamped in gold on the cover and on the spine.

The Mathematics Student Journal. Published October, December, February, and April. First issue published February 1954. Mailed only in bundles of five or more copies to a single address. All subscriptions in a bundle must cover same period of time. Price per person: 20c per year; 15c per semester.

A journal written especially for the secondary school student; designed to contain enrichment and recreational material. Contains a problem department to which students may submit both problems and solutions. Should enliven mathematics classes, create enjoyment of mathematics, and be an interesting challenge to many students.

The Mathematics Teacher. Eight issues per year. Members, \$3.00; non-members, \$5.00. Additional postage per year: Canada, 25c; foreign, 50c.

Contains many worthwhile articles, features, and departments of value to teachers of mathematics.

YEARBOOKS

The yearbooks of the National Council of Teachers of Mathematics are not necessarily published annually but only as the need for them arises. They deal with timely problems in the teaching of mathematics and have been outstanding contributions to the literature in their fields. They serve a need which has been met by no other publications.

Selected Topics in Teaching Mathematics, Third Yearbook, 1928. 284 pp. \$1.00.

Significant Changes and Trends in the Teaching of Mathematics Throughout the World Since 1910, Fourth Yearbook, 1929. 196 pp. \$1.00.

Mathematics in Modern Life, Sixth Yearbook, 1931. 204 pp. \$1.00.

*The Place of Mathematics in Secondary Education,*⁸ Fifteenth Yearbook, 1940. 269 pp. \$3.00.

*Arithmetic in General Education,*⁸ Sixteenth Yearbook, 1941. 347 pp. \$3.00.

*Multi-Sensory Aids in Teaching Mathematics,*⁸ Eighteenth Yearbook, 1945. 460 pp. \$3.00.

*Surveying Instruments, History and Classroom Use,*⁸ Nineteenth Yearbook, 1947. 459 pp. \$2.00.

*The Metric System of Weights and Measures,*⁸ Twentieth Yearbook, 1948. 317 pp. \$2.00.

The Learning of Mathematics, Its Theory and Practice, Twenty-first Yearbook, 1953. 364 pp. \$4.00; \$3.00 to members. Applies the most recent discoveries concerning the nature of the learning process to the problems of the mathematics classroom. Discusses many questions about drill, transfer of training, problem-solving, concept formation, motivation, sensory learning, individual differences, and other problems. For the alert teacher of mathematics, the reading of this book is a must.

Emerging Practices in Mathematics Education, Twenty-second Yearbook, 1954. To be published in April 1954. Will contain materials from many contributors and will discuss the techniques and organization that have been found most useful in the teaching of mathematics. A book full of practical suggestions.

⁸See same title in Secondary School Section for description.

STANDARDIZED MATHEMATICS TESTS

MAX D. ENGLEHART, DIRECTOR, AND MARGARET H. HUMPHREYS, DIVISION OF STUDENT EXAMINATIONS, DEPARTMENT OF SECONDARY EDUCATION
CHICAGO PUBLIC SCHOOLS, CHICAGO, ILLINOIS

A catalog of some of the tests used by mathematics teachers to evaluate the achievement of their students appears here. The information given for each test is, generally: title; author or authors; publisher; publication dates; grade levels; forms; kind of scores or grade points; timing; cost; availability; and charges for specimen tests. For some tests additional information is listed, such as subject matter included in sub-tests, reliability and validity, number of alternate forms, and the method of scoring—by hand or by IBM machine.

In *The Fourth Mental Measurement Yearbook*, edited by Oscar Krisen Buros, (published by The Gryphon Press, Highland Park, New Jersey) seventy-five tests in mathematics are listed and thoroughly described. In this yearbook, a teacher can find reviews of the listed tests written by professors of education, mathematics, or psychology, which critically evaluate the materials in the tests, as well as the reliability, validity, and norms, if the author has given such data in his manual.

Specimen sets may be procured from the publishers by writing on a school letterhead.

Before a test is used in the classroom, it should be:

1. Evaluated in terms of the objectives of the course
2. Examined for the suitability of the questions in terms of language and content
3. Scanned for ease of administering and scoring
4. Taken by the teacher or a small group on a "trial run"

NORMS: If a manual gives specific data about norms, the characteristics of the population on which the norms are based should be compared with those of the groups to be tested. For example, the Minnesota State Board Achievement Examinations Program gives norms for use in Minnesota and then states that similar norms are available from the publishers for others regions by special arrangement.

A consideration in choosing tests is the cost per pupil. If test booklets which have separate answer sheets are used, the booklets may be used repeatedly by supplying additional answer sheets. These may be either of the IBM or the hand scoring type. The IBM machine-scored answer sheets can be hand scored quite easily.

ALGEBRA

Advanced Algebra: Achievement Examinations for Secondary Schools. Edited by Walter W. Cook, prepared by a curriculum committee of high school teachers for use in Minnesota State Board Achievement Examinations. Educational Test Bureau, Educational Publishers, Inc., 1951.

High school level. 1 form; no data on validity or reliability; no manual; Minnesota norms (median and quartile deviation) available. 60 (65) minutes. 7c per test, postage extra.

Advanced Algebra Test: State High School Tests for Indiana. Paul C. Baker, State High School Testing Service for Indiana, Purdue University, 1950.

3 semesters high school. Form B (1950), Form A out of print. Mimeographed; no data on reliability or validity; no manual; norms (1950). 40 (45) minutes. 4½c per test; 15c per specimen set, postpaid.

Algebra Prognosis Test. Corydon L. Rich. C. A. Gregory Company, 1949.

High School and College. 1 form; manual (1949). 6 scores: arithmetic computation, arithmetic problems, number relationships, number series, algebraic formulae, total score. 35 (45) minutes. \$1.75 per 25, postage extra; 35c per specimen set, postpaid.

Algebra Readiness Test. William R. Lueck. Public School Publishing Company, 1947.

Grades 8-9. 1 form (1947); manual. 6 scores: fundamental operations, fractions, decimals, problem solving, general numbers, total. 26 (30) minutes. \$1.80 per 26, 8c per single copy, 2c per class record, 18c per key, 18c per manual, postage extra.

California Algebra Aptitude Test. Noel Keys and Muriel McCrum. Educational Test Bureau, Educational Publishers, Inc., 1940-1950.

High School. 1 form (1940); revised manual (1950); 50 (55) minutes. \$1.75 per 25, postage extra; 50c per specimen set, postpaid.

Columbia Research Bureau Algebra Test. World Book Company.

1 and 2 semesters high school or college; 2 levels; 3 scores: mechanics, problems, total.

(a) Test I. 1 semester; 1929. Joseph B. Orleans, Jacob S. Orleans, Benjamin D. Wood. Forms A, B. 80 (90) minutes. \$1.90 per 25, postage extra.

(b) Test II. Revised. 2 semesters; 1927-1933; first designated Test II in 1929; Form A Revised (1930), B Revised (1931), revised manual (1933). 100 (110) minutes. Arthur S. Otis, Ben. D. Wood. \$2.10 per 25, postage extra. Specimen set — 35c, postpaid.

Co-operative Algebra Test: Elementary Algebra thru Quadratics. L. P. Siceloff (S), Leone E. Chesire (S), Margaret P. Martin, (S,T), Marion F. Shaycoft (T), Robert S. Lankton (Y), Bernice Orshausky (Z). Co-operative Test Division, Educational Testing Service, 1932-1951.

High School. Forms S (1942), T (1943), Y (1948), Z (1950); Forms 1932-1937 N-R out of print; no data on validity; no specific manual; general Co-operative manual (1951); norms (1937). 40 (45) minutes. IBM \$2.50 per 25; 50c per specimen set, postpaid; separate answer sheets may be used; 80c per 25 IBM answer sheets, 15c per stencil for scoring answer sheets; cash orders postpaid.

Co-operative Intermediate Algebra Test: Quadratics and Beyond. John A. Long (S); L. P. Siceloff (S), Leone E. Chesire (S), Margaret P. Martin (T), Marion F. Shaycroft (T), M. Isabel Blyth (Y), and Bernice Orshausky (Z). Co-operative Test Division, Ed. Testing Service.

High School. Forms S (1950 same as test copyrighted in 1942), T (1943) some printings bear a 1951 copyright, Y (1948), Z (1950 — same as test copyrighted in 1949); Forms N-R (1933-1937) out of print; no validity data; no specific manual, general Co-operative manual (1951); norms (1937). IBM. 40 (45) minutes. \$2.25 per 25; 50c per specimen set, postpaid; separate answers may be used; 80c per 25 IBM answer sheets; 15c per stencil for scoring answer sheets; cash orders postpaid.

Elementary Algebra: Achievement Examination for Secondary Schools. Edited by Walter W. Cook; prepared by curriculum committee of high school teachers for use in the Minnesota State Board Achievement Examinations Program. Educational Test Bureau, Ed. Publishers, Inc., 1951.

High School. 1 form; no data on reliability and validity; no manual; Minnesota norms (median and quartile deviation) available; similar norms for other regions by special arrangement with the publisher. 60 (65) minutes. 7c per test, postage extra.

Elementary Algebra: Every Pupil Test, Ohio Scholarship Test. Ohio Scholarship Tests, Ohio State Department of Education, 1929-1951.

High School. New form published each April and December; no data on reliability and validity; no manual; norms (1951). 40 (45) minutes. 2½c per test; 1c per answer key.

First Year Algebra Test: High School Tests for Indiana. Paul C. Baker. State High School Testing Service for Indiana, Purdue University, 1933-1950.

1, 2 semester high school. 1933-1950. 2 levels; mimeographed; no data on reliability or validity; no manual; no norms.

(a) First semester Form B (1950); Form A out of print.

(b) Second Semester Form O (1950); Form N out of print.

40 (45) minutes. 4½c per test; 15c per specimen set, postpaid.

First Year Algebra: 20th Century Test. Ardis Sanders. Benton Review Publishing Co., Inc., 1949.

1, 2 semester high school. 2 levels; Form A; no data on reliability and validity; no norms—author recommends use of local norms. Test I: 1 semester of high school. Test II: 2 semesters of high school. 40 (45) minutes. 10 or more copies — 5c each, postage extra; 35c per specimen set, postpaid.

Iowa Algebra Aptitude Test, Revised Edition. Harry A. Greene and Alva H. Piper. Bureau of Educational Research and Service, State University of Iowa, 1929-1942.

High School. 5 scores; arithmetic, abstract computation, numerical series, dependence and variation, total, IBM. 1 form. 35 (40) minutes. \$1.35 per 25; 25c per manual (1942); 35c per specimen set, postpaid; separate answer sheets may be used; 3c per IBM sheet, 20c per set of stencils for machine scoring of answer sheets, postage extra.

Lankton First-Year Algebra Test: Evaluation and Adjustment Series. Robert Lankton. World Book Company, 1951-1952; c. 1950-1951.

Grades 9-13. IBM; Forms AM (1951), BM (1952); manual (1951); 40 (50) minutes. \$2.15 per 25; separate answer sheets must be used; 80c per 25 IBM answer sheets; postage extra; 35c per specimen set, postpaid.

Larson-Greene Unit Tests in First-Year Algebra. Robert E. Larson and Harry A. Greene. Bureau of Educational Research and Service, State University of Iowa. 1947.

High School. 6 tests in 1 booklet; Forms X, Y; separate answer sheets must be used.

(a) Test I—5 scores: literal notation, simple equations and formulas, simple graphs, directed numbers, total. 40 (45) minutes.

(b) Test II—3 scores: fundamental operations, equations of first degree, total. 38 (45) minutes.

(c) Test III—3 scores: equations of first degree (2 unknowns), special products and factoring, total. 39 (45) minutes.

(d) Test IV—3 scores: fractions, fractional equations, total. 36 (40) minutes.

(e) Test V—3 scores: variation, indirect measurement, total; 38 (40) minutes.

(f) Test VI—3 scores: powers-roots-radicals, quadratic equations, total; 39 (45) minutes. \$3.50 per 25; separate answer sheets must be used; 40c per 25 answer sheets for any one test; 50c per complete set of scoring stencils; 10c per scoring stencil for any one test; 25c per manual; postage extra; 50c per specimen set, postpaid.

Orleans Algebra Prognosis Test, Revised Ed. Joseph B. Orleans. World Book Company, 1928-1951.

High School. 1 form 1950; manual (1951); 39 (44) minutes. \$2.10 per 25, postage extra; 35c per specimen set, postpaid.

Seattle Algebra Test: Evaluation and Adjustment Series. Harold B. Jeffery, Earl E. Kirschner, Philip Stucky, John R. Rushing, David B. Scott, and Otie P. Van Orsdall. World Book Co., 1951.

High School. IBM. Form AM 40 (45) minutes. \$1.75 per 25; separate answer sheets must be used; 80 cents 25 IBM answer sheets; postage extra; 35c per specimen set, postpaid.

ARITHMETIC

Arithmetic Essentials Test. James T. Shea. Steck Company, 1949-1951.

Grades 3-4, 5-6, 7-9. 3 levels, Form A (1941); Form B (1951). No data on reliability and validity; no manual; no norms. Non-timed (40-50) minutes. \$1.80 per 30; 10c per specimen set; postpaid.

Arithmetic: Every Pupil Test. Emma Wiggins, Catherine Ingersall, and Hazel Johnson under the direction of W. G. Williamson. Ohio State Tests. Ohio Scholarship Tests, Ohio State Department of Education, 1930-1951.

Grades 3, 4, 5-6. New form usually published each April and December. 3 levels, Form April 1951; no data on reliability and validity; no manual; norms (1951). 40 (45) minutes; $2\frac{1}{2}$ c per test; 1c per answer key; postpaid.

Arithmetic Fundamentals Test: State High School Tests for Indiana. Doyle T. French and Albert R. Mahin. State High School Testing Service for Indiana, Purdue University, 1944-1945.

High School. Form A (1944), Form B (1944); mimeographed; no data on reliability and validity; no manual; norms (1945). 40 (45) minutes. $4\frac{1}{2}$ c per test; 15c per specimen set; postpaid.

Arithmetical Reasoning Test. Alfred J. Cardall. Science Research Associates, Inc., 1941-1942.

College and adults. Forms A (1941), B (1941); preliminary manual (1942). 40 (45) minutes. 25 for 95c; 50c per specimen set; cash orders postpaid.

Arithmetic Test (Fundamentals and Reasoning): Municipal Tests: National Achievement Tests. Robert K. Speer and Samuel Smith. Acorn Publishing Company, 1938-1939.

Grades 3-6, 6-8. Subtest of *Municipal Battery*. 5 scores: computation, number comparisons, problem analysis, problems, total. Form A (1938), Form B (1939); no data on reliability and validity; no description of normative population in the manuals; no norms for part scores; manuals (1938). 60 (70) minutes. \$1.75 per 25 of any one level; 35c per specimen set of any one level, postage extra.

Basic Arithmetic Skills: Iowa Every Pupil Tests of Basic Skills. Test D, New Edition. H. F. Spitzer in collaboration with Ernest Horn, Maude McBroom, H. A. Greene, and E. F. Lindquist. Houghton Mifflin and Company, 1940-1947.

Grades 3-5, 5-9. 4 scores: fundamental knowledge, fundamental operations, problems, total. IBM for grades 5-9; 2 levels; Form L (1940), M (1941), N (1942), O (1943), P (1944 — Advanced Battery only); manual (1945), Battery manual (1947).

(a) Elementary Battery — (grades 3-5) 57 (65) minutes.

(b) Advanced Battery — (grades 5-9) 63 or 68 (80) minutes.

IBM for Forms O and P. 33c per specimen set of any one level; postage extra.

(a) Grades 3-5 — \$1.60 per 25.

(b) Grades 5-9 — \$1.75 per 25; separate answer sheets may be used with Forms O and P; 63c per 25. IBM answer sheets; 40c per set of stencils for machine scoring of answer sheets.

A Brief Survey of Arithmetic Skills. Arthur E. Traxler. Educational Records Bureau.

Grades 5-12. Form A (1947), B (1947); mimeographed manual (1951); norms (1947). 10 (15) minutes. 5c per test; 25c per specimen set, postage extra.

Brueckner Diagnostic Arithmetic Tests. L. J. Brueckner, H. W. Destad (Fractions), and Abbie Chestek (Fractions). Educational Test Bureau, Educational Publishers, Inc., 1926-1943.

Grades 4-8, or 5-8. 3 tests; 4 scores: addition, subtraction, multiplication, and division; no data on reliability and validity; no norms.

(a) *Brueckner Diagnostic Test in Decimals.* Grades 5-8; 1926-1942. 1 form (1942 — same as test copyrighted in 1926). \$1.25 per 25; 25c per manual (1929); non-timed in part (60-65) minutes in 2 administrations.

(b) *Brueckner Diagnostic Test in Fractions.* Grades 5-8; 1926-1943; 1 form (1942 — same as test copyrighted in 1930); second revised manual (1943); \$1.50 per 25; 35c per manual; 50c per 25 individual diagnostic sheets (1946); non-timed (120-140) minutes in 4 administrations.

(c) *Brueckner Diagnostic Test in Whole Numbers.* Grades 4-8; 1926-1942; 1 form (1942 — same as test copyrighted in 1929); \$1.50 per 25; 35c per manual (1926); 50c per 25 individual diagnostic sheets (1929); non-timed (30) minutes in 4 administrations.

California Arithmetic Test: Revision of Progressive Arithmetic Tests (a subtest of California Achievement Tests). Ernest W. Tiegs and Willis W. Clark. California Test Bureau, 1933-1950.

Grades 1-4, 5; 4-6; 7-9; 9-14; (1933-1950). 3 scores: arithmetic reasoning, arithmetic fundamentals, total; IBM for grades 4-14; 4 levels: Forms AA (1950), BB (1950), CC (1950), DD (1950), manuals (1950).

(a) Primary Grades 1-4, 5; 50 (60) minutes. \$1.50 per 25.

(b) Elementary Grades 4-6; 60 (70) minutes; \$1.50 per 25; separate answer sheets may be used; 4c per IBM answer sheet; 7c per Scoreze answer sheet; 60c per stencil for machine scoring of answer sheets; 20c per stencil for hand scoring of answer sheets.

(c) Intermediate Grades 7-9; 75 (85) minutes; prices same as for elementary.

(d) Advanced — see California Mathematic Test.

35c per specimen set any one level, postpaid. Other prices — postage extra.

Los Angeles Diagnostic Tests: Fundamentals of Arithmetic. Caroline Armstrong and Willis W. Clark. California Test Bureau, 1925-1947.

Grades 2-8. Form 1 (1925), 2 (1925), 3 (1926), 4 (1926); no data on validity or reliability; manual (1947). 40 (50) minutes. \$1.25 per 25, postage extra; 25c per specimen set, postpaid.

Metropolitan Achievement Tests (Arithmetic). Richard D. Allen, Harold H. Bixler, William L. Connor, Frederick B. Graham, and Gertrude H. Hildreth. World Book Company, 1933-1949.

Grades 3-4, 5-6, 7-9.5. 3 scores: arithmetic fundamentals, arithmetic problems, total; 3 levels: Form R (1946), S (1947), T (1949); manual (1948); directions for administering (1947).

(a) Elementary Arithmetic Test. Grades 3-4; 1937-1947; Forms R, S only; 65 (75) minutes.

(b) Intermediate Arithmetic Test. Grades 5-6; 1933-1949; 80 (90) minutes.

(c) Advanced Arithmetic Test. Grades 7-9.5; 1933-1949; 80 (90) minutes.

\$1.55 per 25 of any one level; 80c per manual, postage extra; 35c per specimen set of any one level, postpaid.

Number Fact Check Sheet. Roy Cochrane. California Test Bureau. 1946-1947.

Grades 5-8. IBM. Form A (1946), B (1946); manual (1947); non-timed (25-30) minutes. \$1 per 25 IBM test answer sheets; 60c per set of scoring stencils, postage extra; 25c per specimen set, postpaid.

Stanford Achievement Test (Arithmetic). Subtest of Stanford Achievement Test. Truman L. Kelley, Giles M. Ruch, and Lewis M. Terman. (1922-1946). World Book Company.

Grades 2-3, 4-6, 7-9. 3 scores: arithmetic reasoning, arithmetic computation, total; IBM for grades 4-9; 3 levels: the *Manual for Interpreting* referred to in the directions for administering has not yet been published.

(a) Primary Arithmetic Test. Grades 2-3. 1940-1941. Forms D (1940), E (1940), F (1941); directions for administering C (1940); \$1.25 per 25; 25 (30) minutes.

(b) Intermediate Arithmetic Test. Grades 4-6. 2 editions (1) Hand Scoring Edition. 1940-1943. Forms D (1940), E (1940), F (1941), G (1942), H (1943); directions for administering (1940), \$1.65 per 25; 50 (55) minutes. (2) Separate Answer Sheet Edition. 1941-1946. Forms DM (1941), EM (1943), FM (1946); directions for administering (1941); \$2.30 per 25; 85c per 25 IBM answer sheets; 40c per set of machine scoring stencils for any one form, 55c per 25 profile charts (1942), 60 (65) minutes.

(c) Advance Arithmetic Test. Grades 7-9. (1) Hand Scoring Edition. 1940-1943. Forms D (1940), E (1940), F (1941), G (1942), H (1943); directions for administering (1940); \$1.65 per 25, 50 (55) minutes. (2) Separate Answer Sheet Edition. 1941-1946. Forms DM (1941), EM (1942), FM (1946); directions for administering (1941); \$2.30 per 25, 83c per 25 IBM answer sheets. 40c per set of machine scoring stencils for any one form. 55c per 25 profile charts (1942), 60 (65) minutes.

GENERAL MATHEMATICS

Ability to Do Quantitative Thinking. Iowa Tests of Educational Development, Test 4. Edited by E. F. Lindquist and Paul Blommers. Science Research Associates, Inc., 1942-1951.

Grades 9-13. Profiles for any one of grades 9-12, self-interpreting profiles for students; manual. Scoring, IBM or Manual; Form X2. \$3.75 for 25; separate answer pads or sheets must be used; \$1.95 per 25 answer pads; \$3.00 per 100 IBM answer sheets; 50c per scoring stencil; \$2.50 per 25 first semester (1946) or second semester (1948); profiles for any one of grades 9-12; \$1.00 per 25 self-interpreting profiles for students (1951); 25c per school summary report (1944); 4c per pupil score sheet (1948); 50c per specimen set. Cash orders, postpaid.

California Mathematics Tests. By Ernest W. Tiegs and Willis W. Clark. California Test Bureau. 1933-1950.

Grades 9-14. A revision of *Progressive Mathematics Tests*; a subtest of California Achievement Test; Forms AA (1950), BB (1950), CC (1950); Manual (1950); 3 scores: mathematics reasoning, mathematics fundamentals, total. 68 (78) minutes. IBM or hand scoring. Manual (1950); \$1.50 per 25; 35c per specimen set; separate answer sheets may be used; 4c per IBM answer sheet; 7c per Scoreze answer sheet; 60c per stencil for machine scoring of answer sheets; 20c per stencil for hand scoring of answer sheets; postage extra.

Cooperative Mathematics Pre-test for College Students. Committee on Tests of the Mathematical Association of America. Cooperative Test Division, Educational Testing Service, 1936-1948.

College Entrants. Forms X (1947), Y (1948), (A and B out of print). No data on reliability or validity; no specific manual; general Cooperative manual (1951); Form X, norms (1947). Form Y, norms (1948). 40 (45) minutes. IBM. \$2 per 25; 50c per specimen set, postpaid; separate answer sheets may be used; 80c per 25 IBM answer sheets; 15c per scoring stencil; cash orders postpaid.

Cooperative Mathematics Tests for Grades 7, 8, and 9. Alice H. Darnell (Q, RO), John C. Flanagan (Q, RO), Stevenson W. Fletcher (Q, RO), Rose E. Lietz (Q, RO), Vernon Price (X), and Bernice Orshauskay (Y). Cooperative Test Division, Educational Testing Service, 1938-1951.

Grades 7-9. Forms Q (1950), RO (1941), X (1947), Y (1948). Forms O-P out of print. No data on validity; no specific manual; descriptive folder (1950); general Cooperative manual (1951); norms (1940). 5 scores: skills, facts-terms-concepts, application, appreciation, total. 80 (85) minutes. IBM. Norms (1940). \$2.50 per 25; 50c per specimen set, postpaid; separate answer sheets may be used; 80c per 25 IBM answer sheets; 15c per stencil for scoring answer sheets; cash orders postpaid.

Davis Test of Functional Competence in Mathematics: Evaluation and Adjustment Series. David J. Davis. World Book Company, 1950-1952.

Grades 9-13. Forms AM (1951), BM (1952), Manual (1951). 80 (90) minutes. IBM or manual. \$2.50 per 25; separate answer sheets must be used; 80c per 25 IBM answer sheets; postage extra. 35c per specimen set, postpaid.

Functional Evaluation in Mathematics. Edited by William A. Brownell and Benjamin A. Sueltz. Educational Test Bureau, Educational Publishers, Inc., 1952.

Grades 4-6, 7-9. Form A, 2 levels; 3 tests: Tests 1 and 4, Quantitative Understanding; Tests 2 and 5, Problem Solving; Tests 3 and 6, Basic Computations. 25 (30) minutes per test. IBM for Tests 1 and 4. 50c per manual; postage extra; 75c per specimen set, postpaid. Tests 1 and 4, IBM. \$1.90 per 25 of any one level; separate answer sheets may be used; 85 c per 25 answer sheets; 50c per stencil for scoring answer sheets. Tests 2 and 5, Problem Solving, \$1 per 25 of any one level; Tests 3 and 6, Basic Computations, \$1 per 25 of any one level.

General Mathematics III: Achievement Examinations for Secondary Schools. Edited by Walter W. Cook; prepared by a curriculum committee of high school teachers for use in the Minnesota State Board Achievement Examinations Program. Educational Test Bureau, Educational Publishers, Inc., 1951.

High School. Form: no manual, no reliability or validity data. Minnesota norms (median and quartile deviations) available; similar norms for other regions by special arrangement with the publisher. 60 (65) minutes. 7c per test, postage extra.

Mathematics: Every Pupil Test. Ohio Scholarship Test. Ohio State Department of Education, 1930-1951.

Grades 7-8. New form usually published each April and December. Form, April, 1951 — no data on reliability or validity, no manual; norms (1951). 40 (45) minutes. 2½c per test; 1c per answer key, postpaid.

Rogers Achievement Test in Mathematics for Technical and Industrial Schools. William J. Morgan and William W. Rogers. Psychological Corporation, 1942-1946.

Grades 8-12 and adults. 1 form 1942; no data on reliability or validity; manual, (1946). 30 (40) minutes. \$1.50 per 25; 35c per specimen set; postpaid.

Snader General Mathematics Test: Evaluation and Adjustment Series. Daniel W. Snader. World Book Company, 1951-1952. c. 1950-1951.

Grades 9-13. IBM. Forms AM (1951); BM (1952); manual (1951). 40 (50) minutes. \$2.50 per 25; separate answer sheets must be used; 80c per 25 IBM answer sheets, postage extra; 35c per specimen set, postpaid.

A Test of General Proficiency in the Field of Mathematics: Cooperative General Achievement Tests, Revised Series, Test III. Paul J. Burke (X), Bernice Orshauskay (YZ). Cooperative Test Division, Education Testing Service. 1940-1951.

Grades 10-12; college entrants. Forms X (1947), Y (1948), Z (1951). Forms Q, R-T out of print. 3 scores: terms and concepts, comprehension and interpretation, total; no norms for part scores; no specific manual; general battery folder (1951); general Cooperative manual (1951); norms (1941). 40 (45) minutes. IBM scoring. \$2.50 per 25; 50c per specimen set, postpaid; separate answer sheets may be used; 80c per 25 IBM answer sheets; cash orders postpaid.

GEOMETRY

Columbia Research Bureau Plane Geometry Test. Herbert E. Hawkes and Ben. D. Wood. World Book Company, 1924-1926.

Grades 10-12. 2 booklets: the 2 booklets together called "Augmented Test"; Forms A (1926), B (1926); manual (1926); supplementary manual (1926).

(a) Parts I - II. 1924-1926; 60 (65) minutes.

(b) Parts III - IV. 1926; an optional easy-type test; no data on reliability; 70 (80) minutes. \$1.75 per 25, postage extra; 35c per specimen set, postpaid.

Cooperative Plane Geometry Test. John A. Long (S), L. P. Siceloff (S), Emma Spaney (S), Margaret P. Martin (S, T), H. Vernon Price (Y), Bernice Orshauskay (Z). Cooperative Test Division, Educational Testing Service.

High School. IBM. Forms S (1942), T (1951—same as test copyrighted in 1943), Y (1948), Z (1950); Forms 1932-1937, N-R out of print; no data on validity; no specific manual; general Cooperative Manual (1951); norms (1937). 40 (45) minutes. \$2.25 per 25; 50c per specimen set, postpaid; separate answer sheets may be used; 80c per 25 IBM sheets; 15c per stencil for scoring answer sheets; cash orders postpaid.

Lane-Green Unit Tests in Plane Geometry. Ruth O. Lane and Harry A. Greene. Bureau of Educational Research and Service, State University of Iowa. 1929-1944.

High School. 6 tests in 1 booklet; Forms A (1944), B (1944).

(a) Test I. Fundamental Ideas of Geometry. 35 (40) minutes.

(b) Test II. Parallel Lines and Triangles. 5 scores: indicating what is to be proved, indicating what is given, proving theorems, miscellaneous, total; 38 (45) minutes.

(c) Test III. Rectilinear Figures. 5 scores: same as II; 38 (45) minutes.

(d) Test IV. The Circle. 5 scores: same as Test II. 38 (45) minutes.

(e) Test V. Proportion and Similar Polygons. 5 scores: proportion, proportional lines, proving and applying theorems, miscellaneous, total; 36 (40) minutes.

(f) Test VI. Areas of polygons. 5 scores: computation of lengths of lines and areas of polygons, comparison of areas, proving theorems, miscellaneous, total; 36 (40) minutes.

\$3.50 for 25, separate answer sheets must be used; 40c per 25 answer sheets for any one test; 50c per complete set of scoring stencils; 10c per scoring stencil for any one test; 25c per manual, postage extra; 50c per specimen set, postpaid.

Orleans Geometry Prognosis Test. Revised Edition. Joseph B. Orleans. World Book Company, 1929-1951.

High School. 1 form (1950); manual (1951); 39 (44) minutes. \$2.40 per 25, postage extra. 35c per specimen set, postpaid.

Shaycoft Plane Geometry Test: Evaluation and Adjustment Series. Marion F. Shaycoft. World Book Company, 1951-1952, c. 1950-1951.

Grades 10-13. IBM. Forms AM (1951), BM (1952), manual (1951); 40 (50) minutes. \$2.15 per 25, separate answer sheets must be used; 80c per 25 IBM answer sheets; postage extra; 35c per specimen set, postpaid.

Solid Geometry: Achievement Examinations for Secondary Schools. Edited by Walter Cook; prepared by a curriculum committee of high school teachers for use in the Minnesota State Board Achievement Examinations Program. Educational Test Bureau, Educational Publishers, Inc., 1951.

High School: 1 form; no data on validity and reliability; no manual; Minnesota norms available (median) (quartile deviation); similar norms for other regions available by special arrangement with the publisher. 60 (65) minutes. 7c per test, postage extra.

Solid Geometry Test: State High Schools Tests for Indiana. Philip Peak, Douglass Brown, Margaret Goodson, and Pryce Noe. State High School Testing Service for Indiana, Purdue University, 1934-1947.

Form A (1946)) mimeographed; no data on reliability or validity; no manual; norms (1947). 40 (45) minutes. 4½c per test; 15c per specimen set, postpaid.

Survey Test in Plane Geometry. H. R. Douglass, Richard M. Drake, and Virgil R. Walker. Educational Publishers, Inc., 1939.

High School, 1939. Forms A, B: manual (1939.) 50 (55) minutes. \$1.25 per 25, postage extra; 35c per specimen set, postpaid.

Van Dyke Solid Geometry Test. L. A. Van Dyke. C. A. Gregory Company, 1940.

High School. 1 form; no data on reliability and validity; no manual; no description of normative population. Non-timed (90) minutes. \$1.50 per 25, postage extra. 15c per specimen set, postpaid.

TRIGONOMETRY

Cooperative Plane Trigonometry Test. John A. Long (O, Y), L. P. Siceloff (O, Y) and Staff of Cooperative Test Service (U). Cooperative Test Division, Educational Testing Service. 1932-1951.

High School and College. Forms 1932-1939, O-P entitled Cooperative Trigonometry Test; IBM; Forms O (1950—same as test copyrighted in 1938), U (1950—same as test copyrighted in 1944), Y (1945—some printings bear a 1950 copyright); Forms 1933-1937, P out of print; no data on validity; no specific manual; general Cooperative manual (1951); high school norms (1937); college norms (1942). 40 (45) minutes. \$2.25 per 25; 50c per specimen set, postpaid; separate answer sheets may be used; 80c per 25 IBM answer sheets; 15c per stencil for scoring answer sheets; cash orders postpaid.

Rasmussen Trigonometry Test. Edited by O. J. Peterson and Otho M. Rasmussen. Bureau of Educational Measurements, Kansas State Teachers College of Emporia, 1940.

High School and College. Forms A, B. 40 (45) minutes. \$1.05 per 25; 20c per specimen set; postpaid.

Trigonometry Test: State High School Tests for Indiana. M. W. Keller. State High School Testing Service for Indiana, Purdue University. 1944-1949.

High School. Form B. (1949); Form A out of print; mimeographed; no data on reliability and validity; no manual; norms (1947). 40 (45) minutes. 4½c per test; 15c per specimen set; postpaid.

I often say that when you can measure what you are speaking about and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the stage of science.—Lord Kelvin

PUBLISHERS DIRECTORY

STANDARDIZED MATHEMATICS TESTS

Acorn Publishing Company	9 Front Street	Rickville Centre, New York
Benton Review Publishing Company, Inc.		Fowler, Indiana
Bureau of Educational Measurements, Kansas State Teachers College		Emporia, Kansas
Bureau of Educational Research and Service, State University of Iowa		Iowa City, Iowa
California Test Bureau	5916 Hollywood Boulevard	Los Angeles 28, California
	110 South Dickinson Street	Madison 3, Wisconsin
	206 Bridge Street	New Cumberland, Pennsylvania
Cooperative Test Division, Educational Testing Service		Princeton, New Jersey
Educational Records Bureau	21 Audubon Avenue	New York 32, New York
Educational Test Bureau, Educational Publishers, Inc.	720 Washington Avenue, S. E.	Minneapolis, Minnesota
	3433 Walnut Street	Philadelphia 4, Pennsylvania
	2106 Pierce Avenue	Nashville 5, Tennessee
C. A. Gregory Company	345 Calhoun Street	Cincinnati 19, Ohio
Houghton Mifflin Company	2 Park Street	Boston 7, Massachusetts
	432 Fourth Avenue	New York 16, New York
	2500 Prairie Avenue	Chicago 16, Illinois
	715 Browder Street	Dallas 1, Texas
	500 Howard Street	San Francisco 5, California
Ohio Scholarship Tests, Ohio State Department of Education		Columbus, Ohio
Psychological Corporation	522 Fifth Avenue	New York 18, New York
Public School Publishing Company	509-13 North East Street	Bloomington, Illinois
Science Research Associates	57 West Grand Avenue	Chicago 10, Illinois
State High School Testing Service for Indiana, Purdue University		Lafayette, Indiana
Steck Company	9th and Lavaca Streets	Austin 1, Texas
World Book Company	313 Park Hill Avenue	Yonkers 5, New York
	2126 Prairie Avenue	Chicago 16, Illinois
	6 Beacon Street	Boston 8, Massachusetts
	441 W. Peachtree Street, N. E.	Atlanta, Georgia
	707 Browder Street	Dallas 1, Texas
	121 Second Street	San Francisco 5, California

MATHEMATICS MANIPULATIVE DEVICES

PRIMARY

VIOLA LYNCH, KINDERGARTEN-PRIMARY EDUCATION DEPARTMENT

CHICAGO TEACHERS COLLEGE

BASIC UNDERSTANDINGS

A. B. A. Counter. Educational Playthings. Developed by Nathan Lazar. \$2.00.

This combination abacus and primary counting frame is an excellent aid for recognition and elementary addition and subtraction of units.

Addition and Subtraction Toy. No. 480 Counting House. Playskool. \$7.50.

Feature of this toy is the balancing arm which has two metal suspended trays. Numbers are weighted in such a way that incorrect grouping causes trays to drop out of balance. Encourages early interest in addition and subtraction. Stimulates the imagination and teaches recognition of numbers.

Cash Register. Steel Case. Educational Playthings. \$3.65.

Rings, opens, shows sale.

Chromatic Numeral Frame. Bradley. \$2.75.

A strong wooden frame, with screw and socket handle, giving pupils visual aids to addition, subtraction, and grouping.

Dolch Arithmetic Learning Series: Say-it Addition; Say-it Multiplication; Say-it Subtraction; Say-it Division. Judy. Each \$1.40.

Say-it games that emphasize learning number combinations by methods of repetition. To be used after children have had experience and real understanding of numbers and groups with much manipulative materials. May be played as bingo or lotto to give added skill in basic functions in arithmetic.

Educational Toy Money. Denominations — \$1 to \$20; also 1c to 50c. Bradley. Each, \$1.50.

Toy money with realistic "coins" die stamped on copper and silver paper and "greenback" bills of various denominations. Good for dramatic play in which make-believe money is used for "buying and selling," playing store, etcetera.

The Hundred Chart. Bradley. \$1.50.

A visual aid devised to help teachers show children that there is a method and meaning to our number system.

Ken-Add Machine. Ken-Add. \$6.95.

Small, precision built adding machine with magic slate and stylus. Stylus is used for dialing and for writing numbers or notations on the magic slate. The device can be used by children in totaling figures as they play games or "play store," using the "carry" or the decimal system in relation to dollars and cents.

New Educational Toy Money. Bradley. \$1.00.

A new toy money with 48 crisp, paper bills in large size; also 237 realistic coins in all denominations. Bill denominations from 1 to 20 dollars with the word for "money" translated in ten languages on the face of each.

Number Builders. Bradley. 30c.

A number builder printed on heavy manila tag stock, with large numerals in bold type. The set contains a large quantity of numerals from 1 through 9, and 0 and a set of operation signs. Another box contains a liberal supply of the first ten numerals and the signs of addition, subtraction, multiplication, and division. 20c.

Times Square. Kraeg.

For classroom use. Good for developing number skills in addition, subtraction, multiplication, and division.

Townsend Adding Board. Wooden, 9" x 12". Educational Playthings. \$4.00.

A highly attractive device to aid in the understanding of simple addition. All 45 of the basic number combinations in addition may be worked out on this board. Interesting to manipulate with movable indicator. Self corrective. Large, clear numbers on board and number blocks.

Toy Money. Cardboard coins with bills. Educational Playthings. 75c.

Good for playing store and counting change.

We Play Store. Educational Toys. \$1.95.

Players buy, sell, and make change. Six large cards, 150 counters, including play money.

SIMPLE MEASUREMENTS

Clock Dial. Heavy cardboard, 12" square. Educational Playthings. 75c.

Movable metal hands. Explanation on back of dial.

Clock Puzzle. 13 pieces, brightly colored. Educational Playthings. \$2.00.

Each hour is one separate piece that fits only in its proper place. Hands are movable.

Cubby Compass. Size 9" x 12". Educational Playthings. \$2.50.

A 17-piece puzzle with real compass in center. Simplest way to read a compass while playing.

Easy-Reading Thermometer. 8" wooden back. Bradley. 70c.

Good for classroom use in science and arithmetic. May be used to make the zero meaningful in a functional setting; can be read at a distance.

Educational Clock. Bradley. 75c.

A large clock dial, printed in Arabic numerals, with movable metal hands. Approximate size of average school clock. Serves as a valuable aid in the teaching of time.

Judy Clock. Durable Presdwood dial, 13" high. Educational Playthings. \$2.95.

Hands, partly visible through cutouts, are geared behind dial. Works like a real clock.

Judy Clock for Arithmetic. Judy. \$2.75.

Colorful stand-up clock face with easy to read Arabic numerals to show minute, five minute, and hour intervals. Movable, geared hands are an aid in teaching the correct relationship of minute and hour hands. Good for teaching time-telling in kindergarten and primary grades.

Sun Puzzle. 20 pieces. Educational Playthings. \$2.00.

Seven days of the week and 12 months are separate pieces that fit only in their proper sequence.

Tel Time Clock. 7" square, with folding stand. Educational Playthings. 98c.

Colorfully painted on strong masonite face. Movable plastic hands.

White Enamel Thermometer. 8" metal back. Bradley. 50c.

A tested thermometer in white enamel finish that is clearly visible and practically unbreakable.

VISUAL NUMBER AIDS

A. B. C. Lotto. Educational Toys. \$1.19.

Four different lotto games. Alphabet, counting, objects. For ages 4-7.

Abacus. Write for price. Judy.

A newly designed, inexpensive abacus made of light green presdwood and colorful discs that can be easily manipulated by children for discovering and visualizing number combinations and facts; consists of five rows of inlay boards with round discs easily manipulated.

Checker Boards. Educational Toys. Heavy cardboard: 49c; 39c; 29c; 19c.

Checkers. Educational Toys. Sets: 60c; 29c; 19c.

Embossed wood or plastic.

Chinese Checkers. Educational Toys. Including a set of marbles: \$2.19; \$1.50; 79c.

Colored Sticks. Square, wooden sticks, 1000 in box. Educational Toys. \$1.65.

Various lengths for teaching numerical proportion.

Co-ordination Board. Educational Toys. \$2.50.

Raised geometric shapes. Teaches form and color discrimination. One side is empty for interchanging.

Counting Board. Write for price. 14" x 8½". Judy.

A counting board easily manipulated, much like the abacus with the addition of the printed number name on one side and the number symbols on the other; comes in two sections — numbers from 1 to 5 on one and 6 to 10 on the other.

Counting Cubes. Cubes of 1" in six colors. Educational Toys. Set of 100, \$2.45; 27, 75c.

Helpful in teaching arithmetic. Children learn form and design as well as counting.

Cubical Counting Blocks. Bradley. \$2.00.

One hundred 1" cubes in six standard colors. Good for children beginning to count. Helps them learn form and design.

Domino Games. Educational Toys. Sets: \$1.00; 79c.

Embossed maple blocks.

Dominoes. Double nines. Educational Playthings. \$1.75.

Usable for number concepts and number relations.

Educational Toy: Ten Little Indians. Sifo.

Counting device for young children. Helpful in number recognition and relationships up to ten.

Enlarged Beads. Bradley. Per box, \$5.00.

One-inch wooden beads in shape of spheres, cubes, cylinders. Bright spectrum colors, wax finish. Good for school and home use. Six bead laces.

Enlarged Peg Board. Educational Toys. \$1.95.

Large wooden pegboard, 10" x 10", 100 holes for manipulative play. Used by children in learning numbers, colors, design, and pure manipulation. Pegs to accompany pegboard. Can be used separately for use with number and color. 100 — 50c; 1000 — \$1.95.

Enlarged Peg Board. 10" x 10". Bradley. 75c.

A laminated wooden peg-board, stained finish. Spaced with 100 holes. Pegs 2" x 3/16" available in 6 colors for use with this peg-board.

First Counting Board. Wooden, with colored numbered discs. Educational Playthings. \$3.32.

A simple toy designed to feed the young child's interest in counting and manipulation. He puts discs in holes. Helpful in recognition of quantities they represent.

Fractional Learning. No. 490. Fruit plate, 8" diameter, white bowl. Playskool. \$2.00.

Teaches fractional addition and subtraction; clearly illustrates halves, quarters, and thirds. Extremely realistic; fruit of turned wood on plate is beautifully lacquered in red, orange, and yellow.

Giant Dominoes. Community Playthings.

Attractive to young children who are beginning to be interested in numbers. They are made of wood, large, easy to handle, and come packed in an attractive wooden box. Each domino is 4½" x 2¼" x 1⅛". The dots are turned in, and dominoes and box are of a clear, natural finish.

Judy Clown Bean Bag Game. Judy.

A bean bag game with the right-size target. Large, colorful clown on an easel-like stand that measures 2' x 3'. It is durable, strong, and tempered to withstand hard usage. Six good-sized bean bags are furnished to be tossed into the holes in the clown's suit. Good for counting and learning combinations in arithmetic, as well as for developing motor skills.

Judy Counting Meter. Judy. \$2.75.

Interesting arrangement of movable dials permanently mounted on a colorful presdwood base. The dials operate manually with the correct relationships of ones, tens, and hundreds. Can be used in different ways to demonstrate the meaning and use of the decimal system of counting.

Judy Number-ite Judy. \$2.50.

Combines the use of visual and kinaesthetic senses in fun-to-do puzzle form. The ten large, gay boards, $2\frac{5}{8}$ " x $5\frac{1}{2}$ ", fit together in jigsaw fashion only when the number sequence is accurate. The colored pegs which fit into the holes help children to see and match symbols and groupings.

Jumbo Peg Tray. Educational Toys. \$1.50.

An enlarged variation of old type pegboard with extra large pegs, $2\frac{3}{4}$ " x $5/16$ ", and tray $14\frac{1}{4}$ " x $6\frac{3}{4}$ ". Useful in counting and grouping numbers.

Large Wooden Beads. Educational Toys. \$5.50 per box. Tipped bead strings, black (thin) or colored (thick), 65c a dozen.

Spheres, cylinders, 1" cubes, in bright colors, No. 1110. 144 in wooden box. Good for sorting, counting, and learning shapes and colors.

Number Grouping Frame. Ideal. \$1.50.

A device planned to give to children opportunities for the use of concrete number experiences. The beads can be manipulated to give practice in counting, grouping, and discovering number relationships and problem solving.

Number Lotto. Educational Toys. \$1.75; \$1.00; 60c.

Wooden calling numbers.

Number Puzzles. Educational Playthings. \$1.25.

Self-connecting, for matching numbers with objects. Large, clear numbers with matching objects.

Ring Toss. Bradley. \$1.50.

A good indoor game that can be played in the classroom. Involves skill, action, counting scores, and fun. Box includes 2 bases made with interlocking cross pieces which hold the stakes securely and upright. The rings are made of tightly woven, soft rope.

Spools in Sack. Educational Toys. \$1.00.

Approximately 75 brightly colored spools in different shapes and a strong tipped cord. Good for counting material. Can be put on curtain rod for convenience.

Square Counting Pegs. $1\frac{1}{4}$ " x $\frac{1}{8}$ ". Educational Toys. 85c per box of 1,000.

To be used in counting and sorting. Six bright colors to aid in learning the various colors.

Sum-Fun. Kraeg.

Designed for developing number skills.

Ten-Ten Counting Frame. Bradley. \$2.00.

A counting frame patterned after our number system; 10 rows of 10 counters to be used in developing a simple, basic understanding of arithmetic.

The 390 Basic Arithmetic Facts.[†] Eight records. Each, \$4.25; set of eight, \$30.13; half-sets, records 1-4 or 5-8, \$16.25. Caddy-Imler Creations.

Record 1: *Easier Addition Combinations*; Record 2: *Easier Subtraction Combinations*; Record 3: *Easier Multiplication Combinations*; Record 4: *Easier Division Combinations*; Record 5: *More Difficult Addition Combinations*; Record 6: *More Difficult Subtraction Combinations*; Record 7: *More Difficult Multiplication Combinations*; Record 8: *More Difficult Division Combinations*. These eight 10-inch, 33 $\frac{1}{3}$ rpm, long playing, microgroove, unbreakable records dictate a group of the 390 basic arithmetic facts at three different speeds. On the outer track, a group of facts is dictated at 6-second intervals; on the middle track, at 4-second intervals; and on the inner track, at 2½-second intervals. After teachers teach the number facts in a meaningful way, the records can be used as a diagnostic device for review and for drill. These records may also be a motivating device which pupils find challenging.

[†]Reviewed by Veryl Schult

INTERMEDIATE, UPPER GRADES, AND JUNIOR HIGH SCHOOL
GEORGE L. PATE, WILLIAM J. PURCELL, RUTH B. RASMUSEN, AND JEROME M. SACHS
DEPARTMENT OF MATHEMATICS, CHICAGO TEACHERS COLLEGE

BOOKLETS

Arithmetic in Action. Institute of Life Insurance. Pp. 8. Free.

The story of an arithmetic class discussing insurance. Elementary level.

Athletic Field and Court Diagrams. Lowe and Campbell. Pp. 32. Free.

Contains diagrams of fields and courts of all common American games. JHS.

Budgeting through School Savings; Lessons in Arithmetic through School Savings; School Savings; School Savings in Action; School Savings Journal for Classroom Teachers; Teaching Mathematics through School Savings. Ed. Section, U. S. Savings Bank Div., Treasury Dept. Free.

Deals respectively with place of government bonds in budget; with arithmetic as related to bonds, grades 1-6; school savings programs; stories and articles on bond programs; and problems about school savings, grades 7-9.

The Day of Two Noons. Assn. of American Railroads. Pp. 14. Free.

Tells story of adoption of Standard Time. Suitable for supplementary reading. JHS.

Developing Meaningful Practices in Arithmetic. Central N. Y. School Study Council. Pp. 123. \$2.00.

Practical material for the early elementary, middle, and upper elementary pupils.

The Evolution of the Calendar. World Calendar Assn. Pp. 11. Free.

Describes various systems used as bases for calendars since 4300 B. C. JHS.

Facts You Should Know About Life Insurance. National Better Business Bureau, Inc. Pp. 16. 5c.

Treats the four types of insurance. Pertinent to the new socialized junior high school curriculum.

History of Mathematics in Cartoons. Mel Lieberstein. \$1.50.

Spiral-bound mimeographed pages, cardboard covers. Cartoon and synopsis on each sheet.

How Does It Work. Westinghouse. Free.

Cartoon booklet on atomic power, jets, electronics. Includes some mathematics.

Just for Fun. By Z. L. Loflin and Ida Mae Heard. Mimeographed booklet. South-western Louisiana Institute. Houston T. Karnes. Pp. 55. \$1.00.

Consists of jokes and very short anecdotes classified under arithmetic, algebra, geometry, trigonometry, and home-work; may be used to enliven teaching of mathematics.

Let's Measure Things. Cornell Rural School Leaflet. Pp. 63. 35c.

Broad field of measurement and units of measure; useful for intermediate and senior grades.

A List of Motion Pictures and Filmstrips on Financial Security and A Resource Unit for Teachers: Family Financial Security Education for Mathematics Students. The Committee on Family Financial Security Education. Free.

The first classifies materials under money management, banking, insurance, social security, investments, home ownership, and consumer economics; the second contains topics for a unit, survey of students' financial positions, suggested activities with bibliography, tests, and source material.

Making Par With Your Car and You Bet Your Life. Travelers. Pp. 20 and 32 respectively. Free.

The first is on driving statistics. The second is on practices causing accidents; statistics 1950-1952. JHS and SHS.

Mathematical Pie. R. H. Collin. 2c per copy, plus postage for less than 6 copies.

Periodical on secondary school level. Ideas, puzzles, history, games, and fallacies.

Men of Science. Westinghouse. Free.

Fifteen stories of science, mostly biographies of men who have pioneered in research.

Men of Vision. Better Vision Institute. Free.

Thirty booklets on famous men; some of interest in connection with mathematics.

New Visual Education Techniques. By A. Porter. Burgess. \$1.25.

Uses of felt marking-pens in producing charts, drill cards, drawings, graphs, and games.

Number as the Child Sees It. Manual. Winston. 21c.

Discusses teaching of arithmetic and need for helping children understand arithmetic.

Number Stories of Long Ago. NCTM. 75c.

Reprint of David Eugene Smith's book. Illustrated.

Numbers. By Maud Haddleton. Mimeographed. Industrial Arts Co-operative Service. Pp. 30. 50c.

A collection of facts and drawings about figures, computing devices, money and weights, and measures. Grades 5-12.

Numbers and Numerals. By D. E. Smith and J. Ginsberg. NCTM. 35c.

On history of mathematics. Some topics are learning to count, naming the numbers, fractions, mystery of numbers, etcetera.

One Hundred Problems in Consumer Credit. Pollak Foundation. Pp. 56. 10c.

The purpose is to help people make loans and time purchases more intelligently. Graded: elementary, junior high, senior high, and college level.

Oriental Abacus. Mimeographed. Industrial Arts Co-operative Service. Pp. 6. 25c.

Description and directions for constructing an abacus. Primary and elementary school.

Overweight and Underweight. Metropolitan Life. Free.

Junior high school level discussion of health and calories.

Puzzle Craft. (Kit U). Co-operative Recreation Service. 25c each; 15c each, in dozen lots.

Describes 40 puzzles, many with mathematical implications, which can be constructed of wire, wood, or string.

Railroad Arithmetic Book I; Book II. Baltimore and Ohio. Pp. 44 each. Free.

Practical problems based on real data for the elementary teacher.

The Story of Figures. Burroughs. Free on single copy basis.

Brief history of numbers and fundamental processes plus the development of machines, particularly the Burroughs Adding Machine. Suitable as reference for teachers or for supplementary reading for high school students.

Timekeeping through the Ages. Mimeographed. U. S. Department of Commerce. Pp. 4. Free.

Written for school children. Includes sundial, hourglass, sunglass, clepsydra, candles, clocks.

Twenty Board. Write for price. 24" x 6". Judy.

A newly designed inexpensive twenty-board, arranged to operate vertically instead of horizontally, in such a way that the discs can be easily manipulated in a slot-like device. The discs when moved up disappear on the other side. Used as any twenty-board device.

A Two-Foot Globe. Mimeographed. Industrial Arts Co-operative Service. Pp. 14. 35c.

Directions for making a globe. Grades 4-12.

What Everybody Ought to Know About This Stock and Bond Business. Merrill, Lynch, Pierce, Fenner, and Beane. Free.

Answers questions asked stock brokers about stocks and bonds. JHS and SHS.

Your Money and the Federal Reserve Bank. Federal Reserve Bank. Pp. 32. Free.

Tells the story of banking and the federal reserve system. Shows the data in a social setting.

CHARTS

Blackboard Stencils. Corbett. \$16.95 each.

Flexible stencils for making rectilinear or polar co-ordinate graphs on the blackboard. Junior high school level.

Charts for Arithmetic. Ten charts 10" x 13". Owen. \$1.00.

Poster on each side for display, covering the following topics: measures, a time chart, linear measure, Roman numerals, change for a dollar, kinds of subtraction, temperature, weight, liquid and dry measure, decimals, fractions, interest, long division, and percentage. Useful in the intermediate grades.

Decimal Equivalents. Monroe. Free.

Chart with decimal equivalents to six places. Eighths, sixteenths, thirty-seconds, sixty-fourths on one side; sixths, twelfths, twenty-fourths, thirty-seconds to five decimal places on the other. Also avoirdupois and troy ounces as decimal parts of a pound.

Do You Know These Mathematical Words? How to Read Large Numbers. Scott, Foresman. Free.

Chart showing correct usage of words with glossary of same words giving formal definitions.

Graph Chart. 32" x 40". Mathaids. \$8.50, presswood; \$8.95, duran.

Horizontal and vertical lines drawn at $1\frac{1}{4}$ " intervals to form a rectangular co-ordinate chart.

History of 10,000 Life Insurance Policy Holders. 35" x 37". Institute of Life Insurance. 15c.

Shows, in bright colors, pertinent figures dealing with ordinary life insurance. Can be used in upper grades for difference and ratio comparisons, and interest as well as insurance.

International Metric System. Supt. of Documents. 40c.

Compares and illustrates the English and Metric systems of measure. Should be useful throughout the elementary and junior high school years.

It Makes Solid Sense. Scott, Foresman. Free.

Chart with layout patterns for making models of the cubes, triangular pyramid, rectangular pyramid, triangular prism, hexagonal prism, cone, and cylinder.

National Forum Social Studies Charts. 17" x 22½". National Forum Inc. \$17 per set, with masonite easel.

Useful for the mathematics teacher to develop economic concepts.

Navigation Chart. Colored poster-chart, 35" x 47". Air-Age Education Research. \$1.00.

Tells how cross-country trips are plotted on charts. Junior high school level.

New Welch Metric Chart. (No. 149). 28" x 44". Welch. \$4.75.

By a method of parallel comparison, this chart, consisting of 27 colored illustrations of proportionate size, presents a clear picture of the relationship of units of length, area, volume, and weight of the metric system to each other and similar units of the English system. May be used in any grade where a knowledge of the metric system is desired.

The River Mathematics. Holt. 10c.

Shows the relationships between branches of mathematics. All levels.

Table of Decimal Equivalents. 22" x 36". Starrett. 35c.

The chart is divided vertically into three columns for the exact decimal equivalents for all fractions from $1/64$ to 1 in 64ths.

Ten Years Growth in the United States. Dun and Bradstreet. Free.

Shows, in color, the United States with state boundaries. Bar graphs show civil and business populations and population density by states. Compares 1950 and 1940 figures. Principal products and industries shown for each state.

Tree of Knowledge. Museum of Science and Industry. 25c plus 20c postage.

Chart of science, pure and applied, showing the fundamental position of mathematics. A graphic and decorative method of showing the role of mathematics and the interrelationships of various disciplines.

World Hour Chart. 3¾" x 4½". Newsweek. Free.

Pocket-size chart on which are located the 24 time zones of the world.

Zippo Bar Charts. Zippo. 40c to \$1.25.

Bar charts can be made from these materials by tearing off perforated strips, exposing different color below.

EQUIPMENT

The Abacounter. Abacounter. \$39.50.

A device to afford visual and tactual means for approaching basic number concepts, operations, and processes designed to promote concrete meaning and to develop and strengthen arithmetical insight.

Abacus. Yoder. \$4.00.

3 stainless steel strands each with 10 colored wooden beads. Can be used in teaching the meaning of number.

Addi-Fax. Playway. \$1.50.

Card game in which sum cards are matched to pairs of addend cards. For practice with number combinations.

Addit; Tallyit. Maxim. Each, \$2.00. (Set of 55 cards and 55 discs)

Games to be used for practice with addition and multiplication of one digit numbers. Matching of answer discs to problem on the card.

Addition Wheel. Air Sentry. 25c each plus 10c postage per order. Discounts on orders of 12 or more.

Concentric cardboard circles with answer window for addition combinations of numbers 1 to 10.

Add-O; Count-O; Mult-O. Sanborn. Each \$2.00.

Games, similar to bingo, to provide interesting practice with number recognition and basic operations.

Arithmetic Dominoes. Arithmetic Clinic. Game: 104 cardboard dominoes, $7/8"$ x $2"$. \$1.25.

Each domino has a number on the blue side and an addition fact on the reverse red side. The sum of the addition facts on each domino is the same as the number on the blue side. Provides a variety of ways to present the basic addition facts.

The Arithmetic Educator. Device: electric symbol board; $57"$ x $18"$; keyboard. Huber. \$224.

Consists of a symbol board to be mounted on the wall of the classroom. It has 2 horizontal rows of numbers from 0 through 12 with the symbols $+$, $-$, \times between the rows. A small keyboard on the teacher's desk controls the lights so it is possible to light up numbers and symbols for all number combinations for addition, subtraction, and multiplication from 0 through 12. Guaranteed for ten years.

Arithmetic Readiness Cards: Grouping. Set of cards, $6\frac{1}{2}"$ x $8\frac{1}{2}"$; number cutouts; teacher's guidebook. Scott, Foresman. \$3.20 per box.

Aimed to supply the child with pictorial experiences in the transfer from recognition of small number groups to the understanding of abstract numbers.

Arithmetic Readiness Cards: Number System. Set of cards, $6\frac{1}{2}"$ x $8\frac{1}{2}"$, number cutouts; tabulation cutouts; teacher's guidebook. Scott, Foresman. \$3.20 per box.

Aimed to supply pictorial material useful in developing the basic concepts of our number system.

Arithmetic Speaks: Harr Wagner. \$40.

Through the manipulation of 180 tabs and 85 cards on a counting board and place values board, this complete set is an aid in teaching the structure and the fundamental operations of our number system. Teacher's manual available. For any grade level.

Aritho. Game: $12"$ x $13\frac{1}{2}"$. Psychological Services. \$1.50.

This game, similar to bingo, consists of 15 answer cards, $4"$ x $5\frac{1}{2}"$, with 25 numbers on each arranged in the form of a square. The columns are headed $+$, $-$, \div , and \times ; the four operations make 390 problems. Purpose—a painless method of drill.

Arith-O-Cards (Addition). Arith-O-Card. \$1.00 plus postage.

Set of 119 cards, 4 tables, and directions. Game similar to Rummy. For practice in addition combinations.

Arith-O-Cards (Multiplication). Arith-O-Card. \$1.00 plus postage.

Set of 137 cards, 4 tables, and directions. Game similar to Rummy. For practice in multiplication combinations.

Bobby Duck. Plaway. \$11.

Balancing duck with wooden and plastic weights. Can be used to discover and practice number combinations.

Bulletin Board Wax. Lea A-V Service. \$2.50 per box.

Adhesive wax for mounting three-dimensional objects as well as flat materials on vertical surfaces.

Chinese Abacus. Loy's Chinese Calculator. 6" x 5¼", \$3.50; 10¼" x 7½", \$6.50.

5 columns and 11 columns arranged with 2 beads above the cross bar and 5 below.

Clock Dial. (No. C15). Ideal. \$2.00.

A 15" decorated dial with movable metal hands. For use by teacher in demonstrations with clock in class presentations. For grades 1-6.

Clock Face. Ideal. \$2.00.

Colored clock face decorated with nursery rhymes; plastic hands.

Clock Face. Yoder. \$2.00.

Plastic, laminated cardboard 12" in diameter with 2 steel hands. For use in teaching numbers and time.

Cohere-O-graph. (No. 8B). Winston. \$3.00.

A portable easel with a 19" x 28" black, veloured surface display board. Squares, disks, sectioned disks, and other appropriate cut-outs, lined with colored paper velours, will cohere firmly to the display board.

Combination Fraction Chart and Hundred-board. Winston. \$6.50.

A combination of articles as described.

Cone, Sphere, and Cylinder. Central Scientific. \$4.25.

Hollow models of sheet copper of same height, the diameter of the base of the cone being equal to the diameters of the cylinder and sphere. Three inches high. Useful in discussion of volumes and solids, and in demonstrating the 1:2:3 ratio for these particular volumes.

Counting Discs. (No. 1). Winston. \$4.25.

1,000 manipulative discs for teaching combinations in addition, subtraction, multiplication, and division in grades 1-4. Useful for remedial work in grades 5-6.

Cubic Foot. Model: 1' x 1' x 1'; ¼" plywood. Vis-X. \$5.00.

3 sides are in natural finish and have a common vertex, the other three are marked in inch-squares, with alternating squares painted yellow. Thus the concepts of cubic foot and cubic inches in a cubic foot are clarified.

Cubical Counting Blocks. (No. 100C). Ideal. \$1.70.

100 colored 1" cubical blocks. May be used to teach numbers, fractions, or form and design in grades 1-4; for remedial work in grades 5-6.

Decimal Equivalent Wheel. Air Sentry. 25c each plus 10c postage per order. Discounts on orders of 12 or more.

Concentric circles with answer window for decimal equivalents with numbers 1 through 10 and denominators 2, 3, 4, 5, 6, 7, 8, 10, 12, 16, 32.

Dissectible Liter Block. (No. 120). Welch. \$5.35.

This cubical block is 10 centimeters on each side with grooves cut one centimeter apart over the entire surface. The dissectible features of this device make it useful for giving a visual concept of linear, area, and volume relations of the metric system. May be used in any grade where the metric system is taught.

The Educator Number Fence. Little Red School House. Teacher's Guide Book \$3.00; Demonstration Set \$1.25; Stand \$1.25; Individual Sets \$15 per dozen.

Wooden block with wooden pegs and celluloid dividers for practice with numbers from 1 to 10. Suitable for kindergarten, primary, and for review in intermediate grades.

Enlarged Fractional Parts (without Cohere-O-graph). (No. 8). Winston. \$4.00.

Consists of circles and fractional parts of circles made of the same material but in different colors; may be used to improve the pupil's understanding of common denominators and "what happens" when common fractions are added, subtracted, multiplied, and divided. For use by teacher and pupils in grades 4-6.

Experimenting with Numbers. Houghton. Number Kit, \$32; \$24, each, in quantity.

Represents a new approach to number readiness. The box contains a counting board with number guide, unit box filled with unit blocks and cubes, a set of 10 number cases, a set of 10 number markers, and a teacher's manual.

Flash Cards on a Wheel. Wright. Stand, \$3.50 for wooden; \$1.75 press-bone. Blank card-wheels, 5 for \$1.50. Multiplication and Division card-wheels, 5 for \$3.50. 10 card-wheels, each with 390 basic combinations, \$7.00.

For use in place of flashcards and for practice with basic combinations in multiplication and division.

Fracti-Fax. Plaway. \$1.50.

Two sets of cards, one for the game of matching equivalent fractions and one for the game of matching fractions, decimals, and per cent. For practice in recognizing equivalents.

Fraction Chart. (No. 9). Winston. \$5.75.

Consists of manipulative cards, each card representing a common fraction; aids in revealing the meaning of fractional parts of a group. May also be used to discover decimal equivalents for common fractions. For use by teacher and pupil in grades 4-6.

Fraction Fun. Circles and fractional parts of circles. Frances V. Clark. 50c.

The cards for this game consist of 2 sets of the following fractional parts of a 5" circle: $1/1$, $1/2$, $1/3$, $1/4$, $1/6$, $1/8$, $1/9$, $1/12$. May be used to teach comparison of fractions as well as addition, subtraction, and reduction of fractions.

Fraction Trainers. Robinson Howell. \$3.75.

Plastic circles and parts of circles in color with pamphlet suggesting uses for meaning and understanding of fractions.

Fractional Parts. Winston. \$4.00 per dozen sets.

A set of 49 pieces of fractional parts that show halves, quarters, eighths, thirds, sixths, and fifths. Also one whole disk.

Fractional Parts (enlarged). Winston. Price for Cohere-O-Graph and assortment of parts, \$6.60.

Includes a cardboard, portable easel with a velour surface board, to which disks adhere.

Fractions Made Easy. Ideal. 35c each or \$3.50 per dozen.

Sets of cards marked off in parts varying from halves to sixteenths for providing manipulative experiences with fractional parts.

Fracto-Blox. Arithmetic game $7\frac{1}{2}" \times 7" \times 1\frac{1}{2}"$. Plaway. \$3.95.

45 pieces of $1\frac{1}{2}"$ dowling with their lengths proportional to the fractions stamped on them; the "1" block is 2" long. There are other pieces for $1/2$, $1/4$, $1/3$, $1/6$, and $1/8$.

Hard Fiber Fraction Discs. Yoder. \$2.50.

The fraction discs consist of 2 circles, one red and one white, mounted together so that they may be rotated to show the useful fractions.

Hit. Arithmetic game $7\frac{1}{2}" \times 7" \times 1\frac{1}{2}"$. Plaway. \$1.75.

Consists of 80 pieces of $\frac{1}{2}"$ colored dowling cut in $\frac{1}{2}"$ lengths and 25 cards, $6" \times 7"$, with letters. Also directions for using the game to drill on the 81 products.

Hundred Bead Number Frame. (No. 16). Winston. \$22.50.

By the manipulation of 5 red and 5 yellow beads on each of the 10 rods of this 28" x 28" frame mounted on legs, the pupil is led to an understanding of counting, the "tenness" of our number system, and relationships involving whole numbers, decimal fractions, and percentage.

Hundred-board. Winston. \$4.00.

Consists of a framed cardboard 20" square, a counting card on which the numbers 1-100 are printed, a product card to 10 x 10, and a hundred cardboard disks.

Hundred Spool Number Board. Primary Spool Number Board. Number board, 16" x 16"; 100 spools $\frac{3}{4}$ " in diameter. Winston. \$4.75 each.

The number boards have 100 pegs arranged in 10 rows of 10 pegs in a row. The spools are wooden cylinders which fit over the pegs. The boards differ in that with the primary spool board the spools are colored and the board has no place-value card.

Ideal Fraction Wheel. Ideal. \$2.00.

Colored cards with circles colored or cut out. When superimposed, can be used to develop the fraction concept and to illustrate part to whole and part to part relationships.

Imma Whiz. Kenworthy. \$1.00 each.

One game for drill in the basic addition and subtraction facts and one game for group drill in the basic multiplication and division facts. For elementary school.

Imout. Imout. \$3.65 per set plus shipping charges.

Bingo-type games. One for practice with reduction of fractions, one for practice with products and quotients.

Industrial Drawing Kit (No. 2). 13" x 19". Hammett. \$3.50.

Wooden drawing board, a T-square, and wooden 45° and 30° right triangles. Suitable for scale drawings in grade 8.

Judy Counting Meter. Counting meter, 9" x 16"; three 5" meters. Judy. \$3.00.

Consists of 3 numbered dials connected by gears. Can be used to demonstrate the meaning of numbers by showing concretely the place value of a digit; can also show how meters, such as gas, water, electric, and speedometers, work.

Ken-Add Pocket Adding Machine. Ken-Add. \$6.95.

Small device to add numbers to 9,999. Effective in illustrating the carry-principle.

Large Clock Face. (No. 13). Winston. \$1.90.

A clock face, 11" in diameter, showing minute spaces. Useful in the lower grades for teaching children how to tell time; in the upper grades for teaching standard and daylight saving time, and the time belts.

Magic Numbers. Samco. Single set \$1.25; double set \$2.00. Special rates to educators.

Games requiring addition, subtraction, multiplication, and division of the 45 basic number combinations and sometimes more than one of these operations. Elementary level.

The Magic Teacher Puzzle Plans. Follett. \$1.00 per set of cards.

Jigsaw puzzles to aid in teaching basic facts in addition, subtraction, number concepts, and recognition.

Math-O-Block. Davis. \$3.95; teacher's set, \$10.95.

Number blocks with painted digits; height of block proportional to digit. Can be used to show simple number combinations and to provide concrete illustrations in the basic operations.

Measurement Exercise Cards. (MO 208). Mathaids. \$1.50.

40 numbered cards, of durable cardboard, largest $9\frac{3}{4}$ " x $5\frac{1}{2}$ ", for practice in measuring perimeters and areas of rectangles.

Metric Measure Set. Cambosco. \$8.25.

7 cylindrical metal cups, 10 cc to 1000 cc, for use with material on metric volume.

Mr. Arithmetic. Tutor. Drill recordings; six 10" vinylite records in album, \$10.

A series of number combinations are read; after each combination there is a pause to enable the listener to answer.

Model-Math Square Root Demonstration Kit. Wellbaum. \$1.00.

Cardboard model with squares and rectangles which are manipulated to illustrate the algorithm for square root. Booklet gives careful instructions.

Modernized Abacus. Winston. \$2.75.

4 wires, each with 10 beads, 9 of one color and the tenth the color of the beads in the next row. For use in grades 1-4 for teaching place value and the reading and writing of numbers to 1,000.

Multi-Fax. Plaway. \$1.50.

Card game in which product cards are matched to pairs of factor cards. For practice with multiplication.

Multiplication Wheel. Air Sentry. 25c each plus 10c postage per order. Discounts on orders of 12 or more.

Concentric cardboard circles with answer window for products with factors 1 to 10.

My Arithmetic Teacher. Arithmetic Clinic. \$1.15.

Cardboard base with pegs for illustrating the 4 basic operations and teaching the number facts. Also descriptive booklet.

Number Fact Finder. Winston. Two sizes, \$2.10 and \$2.30 a dozen.

Straight piece of wire with a hook at each end with 10 and 20 beads respectively. These devices are for use in counting and learning number combinations.

Number Frame. Winston. \$2.40 for either size.

The First Year Frame has a wire with 10 large colored beads; the Second Year Number has 20 smaller beads.

Number-ite. Ten 3" x 5½" number boards; 60 pegs. Judy. \$2.50.

Ten boards, numbered from 1 to 10, with a corresponding number of holes on each board. Colored pegs fit into the holes to show grouping.

Number Recognition — Digits and Arithmetic Combinations. Literature, free. Society for Visual Education. Price varies with selections.

Modernized versions of the "flash card principle" that employ filmstrips and projector; also tachistoscopic devices.

Numberland Special. Ideal. \$1.50.

Train with answer cards showing symbols and pictures for practice with addition and subtraction through facts involving 18.

Num-Bo. Plaway. \$3.00.

Number blocks and cardboard base. Thickness of block proportional to number on it. For discovery and practice with numbers less than 10.

Old Woman in the Shoe. Ideal. \$1.00.

Game with answer cards showing symbols and pictures for practice with number facts through the tens.

One Inch Cube Set. (B 205). Mathaids. \$1.00.

A set of 36 one-inch cubes for visualization of fraction and decimal concepts. Also useful for volumes.

Pantograph. Yoder. \$3.00.

4 wooden bars, two 18" and two 20", fitted to mount on the graph board; a mechanical device used to enlarge or reduce drawings, pictures, and diagrams.

Parking Lot Game. Ideal. \$1.50.

Game for practice with multiplication facts. Suitable for grades 4-6.

Parts-Imparter. Extton Aids. \$2.00 per set. Extra discs, \$3.00 per hundred.

Set of 24 small double discs and charts, with instructions. Interlocking bristol board discs for developing part-whole relationships.

Place Value Board. Model: wooden base; 10 wire loops; 10 beads on each loop; comma insert; decimal insert. Ideal. \$3.75.

The purpose of this manipulative device is to visualize place value in our number system. It permits the reading of 10 place numbers.

Place Value Pockets. Winston. \$3.00.

A wooden frame 24" long with three wooden pockets labeled "Hundreds," "Tens," and "Ones."
A supply of cards and rubber bands is included.

Pla-Pak. Game 1½" x 7" x 8". Plaway. \$1.75.

Consists of a boxful of colored wooden objects to teach color, counting, addition, multiplication, and division.

Plastic-Plated Graph Charts. (Nos. 21 and 22). 38" x 50". Modern School Products. \$7.75.

Board mounted black on white for use with wax crayons, tempera, or water color in graphing.

Pocket Pelorus. Texaco Waterways Service. Free.

Cardboard model of pelorus. Compass rose and set of movable vanes. Can be used to illustrate angle, direction, maps, and compasses; for navigation and trigonometry; for meaningful illustrations of use of angles at a much lower level.

Primary Number Cutouts. Winston. \$6.60.

Portable easel with figures of ducks, rabbits, circles, and stars.

Protractor Circle Set. Mathaids. \$5.00.

Set of blackboard protractor and 3 circles of black-coated Duron. May be used to find circumference and develop idea of π as well as for drawings on blackboard.

Round-Up Game. Ideal. \$1.50.

Game for practice with division facts.

Say It: Addition Game; Division Game; Multiplication Game; Subtraction Game. Garrard. \$1.25 each; \$4.50 for set of four.

Lotto-like game to provide practice with addition, division, multiplication, and subtraction facts.

Slidecraft Lantern Slides. Slidecraft. Small size: 100 for \$3.00, with crayons \$3.50. Large size, 25 for \$2.00, with crayons, \$2.50.

Plastic slides on which drawings can be made. They need not be enclosed between sheets of glass for projection or storage.

Spinno. Game-drill device; square base 6" x 6"; 8 disks 6" radius; shields and spinner. Winston. \$1.65 plus postage.

The 8 disks, printed on both sides, contain 4 sets of practice examples for each of the 4 fundamental processes. For grades 3 and 4 for learning; grades 5-8 for remedial work.

Subtraction Wheel. Air Sentry. 25c each plus 10c postage per order. Discounts on order of 12 or more.

Concentric cardboard circles with answer window for subtraction combinations with numbers 1 to 10.

Teach-a-Number Kit. Teach-a-Number. \$3.95.

Different colored blocks for each digit from 1-10. The blocks are labeled with both the notation and the word for each digit. Each is ¼" thicker as one goes from 1-10.

30 Counting Discs. Yoder. \$2.00.

For teaching the meaning of number and the fundamental facts and processes of arithmetic.

Time Telling. Hamilton. Teacher's Manual, pupil lesson sheets, chart. Free.

Explains measurement of time as well as working of watch; much material for science and mathematics. Excellent as supplementary material in upper grades.

The Twenty-board. Winston. \$1.15.

A framed cardboard rectangle large enough to hold 20 cardboard disks in 2 rows of 10 disks each. For addition and subtraction of numbers larger than 10.

Wham. Plaway. \$3.00.

Game using disks and paddles on a numbered board. Can be used in a variety of ways to provide practice with arithmetic operations.

Abacus

Choose a piece of wood 2" x 2" by a suitable length and drill holes to hold the desired number of rods. The rods may be cut from coat hangers and should be about 8" long. Use wooden beads as counters.

(1) To teach the principle of place-value and of the zero in the lower grades use the wooden abacus with beads as a first stage; for the second stage, use a kind of paper abacus in which columns are substituted for rods and numbers are substituted for beads. The columns should bear the necessary headings such as ones, tens, hundreds, etcetera. Finally, use the fully developed symbolism. To represent 306, leave the tens rod free of beads and put no entries in the tens column of the graphic abacus.

(2) To use the abacus for teaching decimals, paint the center white to show that the ones place is the center of the number system. Paint the ends any two colors that show up well.

(3) Variation: One can use a wooden stand with pegs each long enough to hold 9 or 10 plastic disks in which holes have been cut. Plastic disks of 3 different colors may be used to represent ones, tens, and hundreds. The ones disks may be put on the peg until there are no more. Then a tens disk is used to replace the group of ones which may be used over again. Process may be continued until similar performances are made using hundred's place disks.

Area by Covering

To help students acquire the understanding that area means covering by squares, draw a rectangle 8" x 10" on a sheet of white paper or cardboard and rule it in India ink. Cover the area with red and yellow 1" squares. Alternate the colors. Count the pieces and match the information with the length times width idea.

Felt Board

Use a board about 20" x 25" of either wood or fiber and cover with black felt. A string may be attached at the back for hanging. By placing short pieces of wood at the lower corners the board may be made to tilt back slightly while hanging. These pieces of wood can be arranged to fold out of the way when not needed. An easel may also be made, if preferred, as a support for the board.

(1) In primary grades, designs of fish, turkeys, trees, birds, etcetera, cut from felt of contrasting colors, may be used to develop an understanding of numbers.

(2) Cut six 6" circles from felt in such contrasting colors as red, green, yellow, orange so they show up well against a black background. Cut the circles into halves, thirds, fourths, fifths, sixths, eighths, tenths, twelfths, and sixteenths, having more than enough of each fractional part to make them easily available. The parts may be lettered with black india ink. The handling of these parts should aid in understanding fractions.

(3) Instead of felt, the board may be covered with outing flannel. Certain types of art and drawing papers will adhere to the flannel. If necessary, the cutouts may also be mounted on flannel or sandpaper.

(4) Smaller boards, 10" x 10", may be made similar to the above for individual or desk use.

Fraction Chart

Select a piece of white poster board about 22" x 28". On upper half represent *parts of a whole* and on lower half *parts of a group*. On upper half draw 6 circles each having a diameter of 4" — 3 circles to a row. With india ink blacken $\frac{1}{2}$ of the first circle, $\frac{1}{3}$ of the second, $\frac{1}{4}$ of the third, $\frac{3}{5}$ of the fourth, $\frac{2}{3}$ of the fifth, and $\frac{3}{4}$ of the sixth and place at the left of each circle the fraction which the shaded portion represents. On the lower portion draw groups of circles, each circle having a 2" diameter. In the first group blacken one of two circles, in the second one of three, in the third one of four, in fourth three of five, in the fifth two of three, and in the sixth three of four. Note that the same fractions are used in the same order on both portions of the chart. Place the correct symbol at the left of each group. The chart is helpful in teaching parts of a whole and parts of a group or number.

Fraction Chart, Movable.

Use a white poster board about 2' x 2'. In the center of the board outline with india ink a circle whose radius is 6". Outside the circle and around its circumference mark as accurately as possible the following fractions: $1/12$, $1/8$, $1/6$, $1/4$, $1/3$, $3/8$, $5/12$, $1/2$, $7/12$, $5/8$, $2/3$, $3/4$, $5/6$, $7/8$, $11/12$. Mark the first fraction to the right of the highest point on the circle and continue around the circle in a clockwise direction. Superimpose on the circle, to coincide with it, two interlocking circles with the uppermost one white and the under one red. To make interlocking circles slit each circle to the center. Fasten these circles to the board at their centers with a paper fastener that will pass through and bend at the back of the poster board. To make the model more durable use a paper washer with the fastener. The slits should be at the top. Near the slit on each circle attach a tab, with scotch tape, for manipulation. It is very dramatic to watch the red circle appear as the various sizes of fractions are shown.

Fraction Wheel I

Fraction Wheel I may be used for the *comparison of fractions*. Take two paper plates or disks of different colors. Light pink, blue, yellow, green are effective colors. Slit each plate to the center. Start with the slit and mark off in the clockwise direction on the rim of each plate the following fractions: $1/12$, $1/8$, $1/6$, $1/4$, $1/3$, $3/8$, $5/12$, $1/2$, $7/12$, $5/8$, $2/3$, $3/4$, $5/6$, $7/8$, $11/12$. Place the plates together so that they interlock and fasten in the center with a paper washer and a paper fastener that can be bent at the back. Punch a hole in the rim of each plate near the slit and tie a short piece of fluffy thread to use in rotating the disks to demonstrate the different fractions.

Fraction Wheel II

Fraction Wheel II may be used for *addition, subtraction, and comparison of fractions*. The construction is the same as for Wheel I except that one uses 4 plates or disks of different colors. Manipulation permits of many combinations that the child sees grow into being during the process of adding, subtracting, or comparing fractions.

The Fundamental Principle of Fractions

To demonstrate that $3/4$ is equal to $6/8$, etcetera, take a rectangular piece of paper 4" x 12". Fold the 12" length into 4 equal parts making 3" x 4" rectangles. Trace over each crease with a pencil and lightly shade one of the 4 equal areas. The 3 unshaded rectangles represent $3/4$ of the whole. Next fold the strip into 2 equal parts lengthwise and trace over the crease with a pencil. The portion which formerly represented $3/4$ of the whole now represents $6/8$ of it. This experiment demonstrates that $3/4$ is equal to $6/8$ and that $6/8$ is equal to $3/4$. It is possible, of course, to fold in various ways so as to demonstrate many other similar fractional relationships.

A Numbers Mobile

Disks of uniform size may be made from masonite or plastic. Integers are also made so that "1" equals in weight one disk; "2" equals two disks, and so on through "9". To make the mobile balance, the child must hang a number of masonite disks on one side to match the masonite numbers on the other side. For instance 7 disks on one side balance the numbers 4 and 3 on the other side. (See *Time* p. 84, Volume LXII, No. 24).

The 1,000 Board

(1) Choose or prepare a board of moderate weight 17" x 19". This size will permit a border each way while providing for adequate usable surface space. Drill $1/8$ " holes, 30 per line the 17" way, making 33 such lines and 10 holes in the thirty-fourth line. The holes should be spaced one-half inch apart. Paint white lines so that each 30 holes will be arranged into 3 groups of 10. Children will experience the size of 1,000 by placing nails, straw-sippers, or wooden pegs into the holes.

(2) Peg board may be purchased for the above. Since the holes are already drilled in the peg board the over-all size may vary from that given. The cost is very reasonable.

(3) Sound-proofing acoustical tile may also be used for the above project. These tile, 12" x 12", contain 22 holes per line in 22 lines, or 484 holes. Tape may be used to cover the last 2 holes of each line. Colored tape may be pasted between the tenth and the eleventh holes of each line to form 2 tens per line. Three such tile placed next to each other will supply enough holes to teach not only the size of 1,000 but also the formation of 10's, 100's, and 1000's.

The 100 Spools

Thread 100 spools identical in size and shape. Paint every tenth spool to facilitate counting. Spools may be cut with a saw to show decimal equivalents. For example, the 13th spool may be cut in half so that $12\frac{1}{2}$ spools may be separated from the rest to show $\frac{1}{8}$ of the whole. Spools may also be cut to show $\frac{3}{8}$, $\frac{5}{8}$, $\frac{7}{8}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{6}$, $\frac{5}{6}$ of the group. Other fractions may be shown by cutting cardboard 4" circles to their centers and slipping them over the string between spools.

Paper Folding

Many geometric results can be easily reached by paper folding. The theorem of Pythagoras is a striking example. For instructions consult *Geometric Exercises in Paper Folding*, by T. Sudara Rao. The Open Court Publishing Company.

Peg Board With Straws

A peg board may be purchased or made so as to have ten rows of 10 holes — 100 holes. Regular soda or plastic straws should be cut into halves, fourths, eighths, or halves, thirds, and sixths, etcetera. Plastic straws are more durable than regular soda straws; small wooden sticks may also be used. Addition and subtraction of fractions with like and unlike denominators can be taught through the use of concrete materials in using this device. Similar operations may be conducted with mixed numbers when whole straws or sticks are used with fractional ones.

Volume

To teach what is meant by the volume of a rectangular parallelepiped, either use A-B-C blocks or have some cubes cut from wood. Cubes could also be constructed from heavy paper.

SECONDARY SCHOOL

VERYL SCHULT, WILSON TEACHERS COLLEGE, WASHINGTON, D. C.

CHARTS

Aiken Algebra Charts. Descriptive literature available. Nystrom. Set of 24, \$55.25, including stand. Illustrates, with the aid of cartoons, the elementary ideas and processes of algebra. The charts are large, portable, and easily displayed on the stand that comes with them.

Graph Blackboard Charts. Available from Denoyer-Geppert, Nystrom, or Rand McNally. \$10 to \$16 depending on quality.

Useful, convenient, and time savers for making graphs.

Metric Chart. 28" x 44". Welch. \$4.75.

Shows relationships of units of length, area, volume, and weight, in the International Metric System, to each other and to similar units in the English system. Twenty-seven yellow and black illustrations of proportionate size.

Metric Chart. Supt. of Documents. 50c.

Shows the interrelationships of the metric units of measure.

EQUIPMENT

Blackboard Protractor. Babb. \$2.40.

This protractor, 16" in diameter, graduated to single degrees, can be used in junior or senior high school mathematics classes in the study of angles.

Blackboard Stencil. Corbett. \$16.75.

A device for placing on the blackboard a graph outline by rubbing a used eraser over the perforations. Available for rectangular or polar graphs.

Burns Boards: T-1, *Triangles and Their Angles*; T-2, *Quadrilaterals and Parallelograms and Their Diagonals*; T-3, *Polygons*; T-4, *Pythagorean Theorem*; T-5, *Altitudes of Triangles*; T-6, *Circle Circumscribed about a Triangle*; T-7, *Triangles Equal in Area*; T-8, *Angle Inscribed in a Semi-Circle*; T-9, *Medians of Triangles*; T-10, *Perpendicular Bisector*. Ideal. \$3 each, or \$25 for teacher's set of ten.

Sensory aids for more effective learning of intuitive and demonstrative geometry. Flexible.

Caliper, Micrometer. (Student) Range 0 to 25 mm by .01 mm — metric graduations, or Range 0 to 1 inch by .001 inch — English graduations. Welch. \$3.95.

Can be used in any basic or applied mathematics class to show practical applications of decimals in measurement, and of the metric system. The usefulness of this widely used mathematical instrument can be demonstrated in making precise measurements.

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Cone, Sphere, and Cylinder. Diameter and height of each, 7.5 cm. Welch. Set, \$5.75.

Useful to illustrate that the ratio of the volumes of these 3 solids is as 1:2:3, when $h = 2r$.

Cubical Blocks. 100 one-inch blocks in 6 colors. Bradley. \$2.50.

Useful in building the concept of cubic measure and in developing the formulas for the volume of rectangular solids and cubes.

Dissectible Cone. Height, 22.5 cm, base diameter 15 cm. Welch. \$15.

Illustrates the conic sections by walnut, cherry, and maple sections of the cone.

Dynamic Geometry Instruments, by John F. Schacht: *Triangle with Constant Midpoint*, *Triangle with Sliding Point*, *Quadrilateral with Constant Midpoint*, *Universal Circle*, and *Schacht Manual*. Welch. \$7.50, \$6.50, \$8.50, \$8.00, and 50c respectively.

Models, made of durable aluminum, which can illustrate many relationships in geometry. Being flexible, they can illustrate constant relationships under variable conditions.

Eyelet Punch. Bradley. \$3.50. Eyelets, 45c per box.

Useful in making many flexible models in geometry, such as quadrilaterals and linkages.

Geometrical Solids and Surfaces. Welch. Set, \$6.00.

This set of 23 solids of hardwood, packed in a hardwood box, is useful in the study of geometrical figures in junior and/or senior high school. Durable enough for pupil-handling.

Geometrical Surfaces and Solids. Yoder. Unfinished, \$8.50; colored, \$10.

Set consists of a total of 44 pieces — 24 solids, 17 faces, 3 angles — in a wooden box.

Grove's Moto-Math Set. Yoder. \$35; Manual, 30c.

Consists of a specially designed blackboard graph chart in hardwood frame with numerous accessories such as pins, elastic, protractors, linkage set, abacus, pantograph, easel, etcetera. Complete set illustrates problems in any branch of elementary mathematics. The manual describes detailed uses of the set.

Liner (Blackboard). Metal, with adjustable spaces between chalk. Bradley. \$2.75. Five spring wire fingers, with wooden hand grip. 50c.

Useful in drawing horizontal and vertical parallel lines, five at a time, on the blackboard when graphs are being studied.

Liter Block. 10 x 10 x 10 cm. Welch. \$5.35.

Helpful in visualizing the concept of linear, area, and volume relationships in the metric system. One upper edge is dissectible from the main block; the last cubic centimeter is separate.

Material for Making Homemade Slides. Free descriptive literature. Teaching Aids Service. Glasive, \$1; Celloslide, package \$1.

The products are helpful in making non-photographic slides on prepared ground glass or on cellophane.

Pantograph. Wooden. Hammett. \$1.95 list.

Demonstrates proportion and similar figures in enlarging and reducing drawings.

Slated Globe. 12" diameter. Rand. \$14.25.

Very useful in solid geometry and spherical trigonometry in the study of the measurement of the sphere, and the theorems about it.

Slide Rules. Welch. 10" for beginners, 35c; demonstration size, \$8.50. Various types also available from Keuffel and Esser Company, Lawrence Engineering Service, Pickett and Eckel, Inc., and others.

Not only useful in mathematics classes but also of value in some science classes.

The Speed-Up Geometry Ruler (plastic). Speed-Up. \$7.80 per dozen.

Combines in a 4" x 8 $\frac{1}{4}$ " space, an 8" rule, a 20 cm. rule, a protractor, and 14 cut-out geometric figures to facilitate drawing them.

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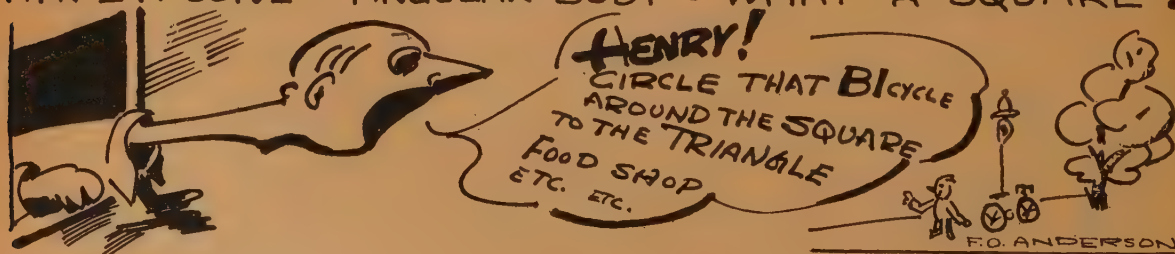
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A SELECTED, ANNOTATED BIBLIOGRAPHY FOR TEACHERS OF ARITHMETIC

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ELLA MARTH, WILSON TEACHERS COLLEGE, WASHINGTON, D. C.

BJARNE R. ULLSVIK, ILLINOIS STATE NORMAL UNIVERSITY

Andrews, F. E., *New Numbers*. Harcourt, Brace, 1935. Pp. 168. \$2.00.

A case is built for an emancipation from the present uncivilized number system to a civilized system using 12 as a base, or the duodecimal system. This book can serve as a teacher diversion and may be of interest to a gifted pupil who is motivated to learn of the history and basis of our conventional number system.

Bakst, A., *Approximate Computation, Twelfth Yearbook of the National Council of Teachers of Mathematics*, 1937. Pp. 287. \$1.75.

A comprehensive treatise on the theory of approximate computation with practical applications. Other references are more suited for teachers who desire teachable rules. Some parts of this book are easy to read; other parts require a more substantial understanding of mathematics.

Ball, W. W. R., *Mathematical Recreations and Essays*.⁴

Bell, E. T., *Men of Mathematics*. Simon and Schuster, 1937. Pp. 592. \$6.00.

Professor Bell is one of the most prolific writers on modern mathematics which can be adapted for use by the high school teacher. Rather than provide an historical development of mathematics, he provides biographies of famous men of mathematics in such an order that an historic perspective is provided. This view of history through biographies is beautifully written and contains much of interest to students of mathematics.

Bendick, Jeanne, *How Much and How Many*. Whittlesey House, McGraw-Hill 1947. Pp. 182. \$2.75.

The story of weights and measures is fascinatingly presented in this book. The concepts are organized according to occupations or areas of living and are developed with the reasonableness of need in carrying on a trade, vocation, or making a transaction. Clever drawings and easy reading make the text valuable as resource material for both pupils and elementary school teachers. Interesting and attractive, but not always accurate.

Bond, E. A., *The Professional Treatment of the Subject Matter of Arithmetic for Teacher-Training Institutions, Grades I to VI*. Teachers College, Columbia University, 1934. Pp. 315. \$2.50.

Topics concerning the teaching of arithmetic are presented in terms of historical development, social uses, mathematical principles, experimentation, philosophy, and suggested standards of proficiency. This organization will prove helpful to teachers searching for aid on a particular concept and those searching for more unification in teaching procedures. The organization as well as content makes this book valuable for a school library.

Boyer, L. E., *Introduction to Mathematics for Teachers*. Holt, 1945. Pp. 478. \$4.50.

This book attempts to provide the kind of mathematics necessary for the elementary teacher to grasp the significance of the mathematical operations and problems characterizing elementary and secondary mathematics. Much of the mathematics presented may seem irrelevant, but for those elementary teachers who would like to have a ready resource of familiar derivations in elementary algebra, geometry, and trigonometry, this book should prove to be a valuable supplement.

Breslich, Ernst, R., *Excursions in Mathematics*. Orthovis, 1938.

Presents the uses of common geometric figures in design, nature, and practical matters. Characteristics of the figures are noted and some of the measurement formulas are developed. A series of pictures to be viewed through the orthoscope which accompanies the book makes the three-dimensional aspects stand out clearly.

⁴See same title in the Junior College Section for description

Brownell, W. A., *Arithmetic in Grades I and II. Meaning vs. Mechanical Learning — Grade III Subtraction*. Duke University Press. 1941 and 1949 respectively. \$2.00 and \$3.00 respectively.

Dr. Brownell is considered one of the leaders in the teaching of arithmetic. His publications indicate thoughtful and conscientious research, and his recommendations are based upon experimentation, not mere opinion. Some of his recommendations may seem contrary to popular trends, but his logic and substantiating evidence can hardly be ignored. Amplification of his ideas can easily be found in his many publications.

Brueckner, L. J., *Diagnostic and Remedial Teaching in Arithmetic*. Winston, 1930. Pp. 341. \$2.00.

Designed to indicate methods for reducing failures in arithmetic; suggests procedures to eliminate difficulties which deter pupil progress. Emphasis is given to methods for diagnosing pupil difficulties, testing procedures, and the application of appropriate remedial measures. Consideration is given to kinds of difficulties in arithmetic that have been uncovered by published research or as conducted by Dr. Brueckner. Many teachable techniques are suggested.

Brueckner, L. J. and F. E. Grossnickle, *How to Make Arithmetic Meaningful*. Winston, 1947. Pp. 513. \$4.00.

Only the operations and number concepts of the first six grades are presented. The organization is more adaptable for a teacher's course in arithmetic than for use as a resource unit. Interpretation of research is incorporated rather than explained. Because of the comprehensive treatment of arithmetic in the first six grades, this text is valuable for busy teachers seeking efficient help in recommended teaching procedures, individual diagnosis, and techniques for evaluation of teaching effectiveness.

Brueckner, L. J. and F. E. Grossnickle, *Making Arithmetic Meaningful*. Winston, 1953. Pp. 576. \$4.40.

This professional book deals with the arithmetic program in the elementary school, and is valuable to prospective teachers as a comprehensive treatment of methods functionally illustrated and to teachers in service who wish to know the newer methods which have been successful in producing meaningful outcomes. Special problems, such as techniques of evaluation and adapting instruction to individual differences, have been treated.

Buckingham, B. R., *Elementary Arithmetic*. Ginn, 1947. Pp. 774. \$5.50.

Much material is presented in an attempt to provide for understanding and meaning attached to numbers and operations used in arithmetic. A good source for the ambitious teacher who is concerned with teaching for understanding and searching for additional information to fill in the gaps evidenced in the usual textbook. One of the best books to date designed for this purpose. The completeness of presentation is its best feature.

Buswell, G. T. and Lenore John, *Diagnostic Studies in Arithmetic*. University of Chicago Press, 1931. Pp. 212.

A detailed report of analyses of pupil difficulties in arithmetic as revealed through study of eye movements, time analysis, and close observation of an individual. The last mentioned method can be used by the classroom teacher; the results presented indicate many of the difficulties that can be expected from the typical pupil. Emphasis is placed upon need for teachers to study mental processes of individual students to determine difficulty as well as apply appropriate remedial measures.

Dantzig, T., *Number: The Language of Science*. Third Edition revised and enlarged. Macmillan, 1939. \$4.50.

A very interesting development of the importance of number concept in human affairs is presented. Many interesting examples are given to provide for an understanding of modern number concepts. Although parts of the text are difficult to comprehend, the entertaining style sustains interest throughout. The content is unique in that few other books present the same organization. The text has been popular since its first edition.

Freeman, Mae and Ira M. Freeman, *Fun with Figures*. Random House, 1946. \$1.50.

A series of simple explanations and experiments designed to develop understanding of the characteristics and uses of common geometric figures. Well illustrated with suitable and attractive photographs. Useful in the elementary grades. Many high school students will enjoy it.

Glennon, V. J. and C. W. Hunnicutt, *What Does Research Say about Arithmetic?* Association for Supervision and Curriculum Development, 1952. Pp. 45. 50 cents.

Thirty-eight questions, asked by teachers, are presented together with the answers provided by the findings of pertinent research studies. Part I is made up of questions of broad significance, such as "Why is it important to develop meanings in arithmetic?"; Part II deals with such questions as "Which method for estimating the quotient figure should be used?" References to supporting research are cited and a bibliography is provided.

Hickerson, J. A., *Guiding Children's Arithmetic Experiences: the Experience-Language Approach to Numbers*. Prentice-Hall, 1952. Pp. 322. \$5.00.

Part I is devoted to a discussion of the purposes of arithmetic in the chapters entitled "Learning to Represent Concrete Situations with Symbols," "Learning to Compute with Meaning and Efficiency," and "Understanding the Number System." Parts II and III present detailed analyses of the "steps" in teaching computation with whole numbers and fractions. An appendix lists in- and out-of-school uses of arithmetic arranged according to grade level from kindergarten through sixth grade.

Hogben, L., *Mathematics for the Million*. Norton, 1937. Pp. 647. \$3.75; revised edition, \$5.75.

This is one of the few books on mathematics which has been a best seller. Much historical information is provided in order to show that mathematics is a "mirror of civilization." Some parts of the book may be read by gifted upper grade pupils but, in general, the book can only serve as a resource for teachers. Entertainingly written, with many illustrations, by a scientist who is interested in mathematics.

Hooper, Alfred, *The River Mathematics*. Holt, 1945. Pp. 401. \$3.75.

Mathematics is likened to a river passing through the ages, beginning with counting and soon separating into geometry and beginnings of algebra. The river unites by emptying into a sea of calculus, analytical geometry, and trigonometry. This presentation results in an historical overview with much interesting explanation of how important mathematics has been in the development of modern technology. Only the gifted elementary school pupil could secure much profit; the teacher would read the book somewhat as a novel.

Hooper, V. F., *Medieval Number Symbolism*. Columbia University Press, 1938. Pp. 241. \$2.90.

Teachers interested in "classics" should find this book interesting. A scholarly presentation of Astrological and Pythagorean number theory supplemented by number concepts as held by the early Christian writers displays an interplay of religion, science, and philosophy. This book is not designed for the classroom, but will prove interesting to the teacher with the urge to learn of number lore.

Kokomoor, Franklin Wesley, *Mathematics in Human Affairs*. Prentice-Hall, 1943. Pp. 730. \$5.00.

Written for the person of average ability, this book begins with the simplest concepts and develops them so that they may be readily understood in higher mathematics. Each chapter concentrates on a topic and develops it so that the reader is oriented into understanding how mathematics functions for the benefit of humanity. The study guide and questions at the end of each chapter are helpful.

Larsen, H. D., *Arithmetic for Colleges*. Macmillan, 1950. Pp. 275. \$3.75.

Designed to help teachers develop their own competence in arithmetical processes. There are chapters on the fundamental operations with whole numbers, fractions, decimals, percentage, measurement, approximate computation, and the slide rule. Historical notes and practice exercises are included for each topic; attention is given to methods of checking and to recreational problems.

Leaf, Munro, *Arithmetic Can Be Fun*. Lippincott, 1949. \$2.25.

A book for the lower elementary grades, effectively illustrated. About two-thirds of it is devoted to the meaning of numbers, the role of zero in writing numbers, and the meaning of the operations. The rest relates to measurement and to the common units of measure.

The Learning of Mathematics — Its Theory and Practice, *Twenty-first Yearbook of the National Council of Teachers of Mathematics*. 1953. Pp. 355. \$4.00; \$3.00 to members.

Twelve authors contributed various aspects of the process of learning mathematics in the elementary and secondary schools. Such topics as theories of learning, motivation, problem-solving, and language are discussed. Illustrative examples are cited from the elementary as well as the secondary level. Good bibliographies are provided at the ends of chapters.

Mathematics in General Education. Report of the Committee on the Function of Mathematics in General Education for the Commission on the Secondary School Curriculum. Appleton-Century. Pp. 423. \$3.75.

This text, designed primarily for the secondary school curriculum, contains implications for the general educational value of both arithmetic and secondary school mathematics. It is more helpful to the teacher searching for new and different pupil experiences than to the teacher attempting to improve teaching with an agreed upon text or traditional sequence. Ideas are presented which are characteristic of the thinking of the leaders and pioneers rather than those of the followers. One of the best for the teacher with ideas.

McKay, H., *Odd Numbers.* Macmillan, 1940. Pp. 215. \$2.50.

An English book written in an attempt to give meaning to numbers which are sometimes considered to be of little value. Interesting illustrations of history, use, and value of millions, billions, trillions, logarithms, weights and measures, approximations, and scales of notations make good reading. The illustrations are gauged to English life, but American teachers can find much enlightenment in regard to some of the neglected values of numbers.

The Measurement of Understanding. Forty-fifth Yearbook of the National Society for the Study of Education, Part I. University of Chicago Press, 1946. Pp. 338. \$1.75, \$2.00, or \$3.00.

This yearbook provides teachers with new ideas on the measurement of objectives which are usually not measured by the conventional commercial tests. Information and procedures are provided for securing evidence as to whether or not teachers are achieving some of the objectives to which they too often give only lip service. Those desiring to measure for more than manipulative skills will find this publication helpful.

Morton, Robert Lee, *Teaching Children Arithmetic.* Silver Burdett, 1953. Pp. 556. \$4.50.

This book has two purposes: to serve as a text for students who are preparing to teach in the elementary school and as a handbook for teachers in service. The author presents a program which takes account of the structure of arithmetic, the ways in which children learn best about numbers, and the social situations in which arithmetic may be taught functionally. The subject matter is presented topically but each topic is analyzed and the concepts and meanings appropriate to each grade level are then listed according to grade.

National Council of Teachers of Mathematics: *Second Yearbook, Curriculum Problems in Mathematics, 1927*; *Tenth Yearbook, The Teaching of Arithmetic, 1935*; *Sixteenth Yearbook, Arithmetic in General Education, 1941.* \$3.00 each.

Annually a yearbook concerning the teaching of elementary and secondary school mathematics is published. The yearbooks have been more concerned with secondary than with elementary school teaching, but each of the three listed can be read with profit by elementary school teachers. They contain research studies and statements by leaders in the teaching of arithmetic and should be indispensable for the teacher intent upon creating new curricular concepts or trends.

Risden, Gladys, *How Big? How Many? Arithmetic for Home and School.* Christopher, 1951. Pp. 248. \$3.50.

An informally written book with many suggestions for teachers who wish to promote understanding and intelligent use of number and arithmetical processes. The five parts relate to the meaning of numbers less than ten, grouping about the base ten, the fundamental processes, fractions, and measurement. Useful for parents as well as teachers.

Robinson, Arthur E., *The Professional Education of Elementary Teachers in Arithmetic.* Bureau of Publications, Teachers College, Columbia University, 1936. Pp. 193. \$2.10.

A research conducted to suggest the kind of experiences elementary school teachers need to successfully teach arithmetic. Helpful to supervisors and others concerned with in-service program in teacher improvement.

Rosenquist, Lucy Lynde, *Young Children Learn to Use Arithmetic.* Ginn, 1949. Pp. 175. \$2.75.

Devoted to the teaching and learning of arithmetic in the kindergarten and first and second grades. Ten principles governing teaching in the early years of school are discussed and a program of understandings and skills is suggested. Three maturity levels in the learning process are emphasized throughout. Teaching procedures, together with helpful materials appropriate to each grade, are presented. A bibliography accompanies each chapter.

Sanford, V. A., *A Short History of Mathematics*. Houghton Mifflin, 1930. Pp. 402. \$4.50.

This is one of the best references containing a ready source for historical information for the teaching of elementary and secondary mathematics. Although the title indicates an abbreviated history, the treatment is complete enough for the needs of both elementary and secondary school teachers. The book is concerned more with the ancient and medieval development of mathematics than with the advanced and modern development.

Shackle, G. L. S., *Mathematics at the Fireside*. Cambridge University Press, 1952. Pp. 156. \$3.25.

Intended "to give to quite young people a grasp of that small number of architectonic ideas on which mathematics is founded." Written in the form of a series of conversations between an adult and two children, it presents the successive stages in the development of the number concept, including basic ideas from analytic geometry, calculus, and algebra. Many teachers will find it interesting and useful for enriching their own backgrounds.

Smith, David Eugene —

Number Stories of Long Ago. Ginn, 1919. Pp. 136. 50c. An entertaining "storytelling" of the development of number concepts through the ages. Ancient stories from China, Egypt, Greece, India, Japan, Italy, and England provide a fireside chat for interested elementary school pupils. Popular since its publication because of its "homey" approach; children will continue to benefit from it.

Wonderful Wonders of One-Two-Three. McFarlane, 1937. An account of the history of our number symbols; comparison with those used elsewhere now and in earlier times. Magic squares and circles; curious sums and products.

Smith, David Eugene and Jekuthiel Ginsburg, *Numbers and Numerals*. Teachers College, Columbia University, 1937.

An historical account of the development of number symbols, forms of notation, and methods of computation. Also discusses superstitions associated with numbers; number "pleasantries."

Spencer, P. L. and Marguerite Brydegaard, *Building Mathematical Concepts in the Elementary School*. Holt, 1952. Pp. 372. \$3.75.

The authors believe that effective teaching of arithmetic rests upon the provision of learning experiences which make the learner aware of quantity, help him develop fundamental concepts with respect to quantity and number, and help him to discover effective ways for dealing with quantity as he meets it. Emphasis throughout the book is upon ways of facilitating pupil discovery and generalization. Illustrative lessons for children from nursery school age through the sixth grade and photographs of learning situations are included; lists of related readings are provided.

Spitzer, H. F., *The Teaching of Arithmetic*. Houghton Mifflin, 1948. Pp. 397. \$3.25.

This text is designed to teach teachers. Much emphasis is given to teaching for meaning and the need for children to arrive at their own generalizations for effective learning. A philosophy toward teaching is presented rather than many illustrations concerned with learning of content. Helpful study questions are provided as discussion topics for groups of interested teachers.

Stern, Catherine, *Children Discover Arithmetic*. Harper, 1949. Pp. 295. \$4.50.

This book attempts to introduce "structural arithmetic" through use of Gestalt psychological concepts. The methods presented are an attempt to utilize the discovery intent of pupils to learn number concepts and meanings attached to operations. The ideas are strange to the teacher of traditional arithmetic, but the teacher dissatisfied with the present methods may secure new insights for more meaningful teaching. Structural arithmetic is designed to give meaning to arithmetic for everyday living and to provide a background for future scientists.

Stokes, C. Newton, *Teaching the Meanings of Arithmetic*. Appleton-Century-Crofts, 1951. Pp. 523. \$4.50.

Designed to present the theory and practice of teaching meanings to teachers in service and to students preparing to teach in the elementary school. The first three parts deal respectively with the three questions: "Why should meanings be taught?" "What understandings should be presented?" and "How should these be taught?" Part IV contains a developmental program for each age level of children from six through eleven years.

Taylor, E. H. and C. N. Mills, *Arithmetic for Teacher-Training Classes*, Third Edition. Holt, 1949. Pp. 441. \$3.90.

Designed to present both methodology and content; many appropriate illustrations indicate the importance of arithmetic in modern life. The explanations are rigorous yet clear. The authors have had wide experience in teaching arithmetic to teachers; text indicates a balance between "social utility" concept and substantial content. Many practical problems are presented to illustrate the value of teaching arithmetic to better interpret problems of concern to the welfare of an individual and his community.

The Teaching of Arithmetic, Fiftieth Yearbook of the National Society for the Study of Education, Part II. University of Chicago Press, 1951. Pp. 302. Paper, \$2.75; cloth, \$3.50.

The fifteen contributors to this *Yearbook* take the position that effective use of arithmetic in society must rest upon thorough understanding of number and relationships within the number system. Both the mathematical and the social phases of arithmetic are emphasized in the various sections of the book which deal with the nature of arithmetical learning, the arithmetic program at different grade levels and types of curriculum organization, instructional materials, and the preparation of teachers of arithmetic.

The Three R's in the Elementary School. Association for Supervision and Curriculum Development, 1952. Pp. 152. \$1.50.

Although only a part of this book is devoted to arithmetic, it contains so much valuable material it is suggested for teachers in service as well as for students of elementary education. It presents the viewpoint that the functional abilities in the three R's needed in today's living are best developed in a total meaningful situation, thus giving arithmetic its rightful place in the whole program. The chapter on arithmetic discusses its function in children's lives today; presents instructional considerations, such as the importance of experiment and discovery; and gives consideration to basic understandings fundamental to learning about numbers.

Urbancek, Joseph J., J. T. Johnson, and Don C. Rogers, *Arithmetic Teaching Techniques*. Chicago Board of Education, 1949. Pp. 348. Write Joseph J. Urbancek, Chicago Teachers College.

This book is the culmination of an in-service study lasting nearly four years. Its 349 above average arithmetic teaching techniques were selected from more than 1,300 by a committee of 27 teacher experts. All techniques were developed by Chicago's elementary teachers in response to a request for teaching methods for overcoming 29 categories of teaching difficulties, under the seven major areas of vocabulary, mechanics of reading, arithmetical, teaching, textbook, problem analysis, and reasoning. Very helpful to teachers of arithmetic.

Van Engen, H., *Arithmetic Developing the Fraction Concept in the Lower Elementary Grades*. Iowa State Teachers College, 1946.

Dr. Van Engen is a mathematician who is vitally interested in the teaching of arithmetic. His comprehensive understanding of mathematics enables him to look from "above" and provide a mathematically consistent development in both elementary and secondary mathematics.

Weeks, Raymond. *Boys' Own Arithmetic*. Dutton, 1924. \$2.50.

A humorous book made up of stories containing arithmetic problems. Children find it entertaining. It is thought-provoking as well. The range in difficulty is considerable.

Wheat, Harry Grove, *How to Teach Arithmetic*. Row, Peterson, 1951. Pp. 438. \$3.00.

Designed for teachers of arithmetic and students who are preparing to teach in the elementary school. The first eight chapters deal with the content and procedures appropriate to the first eight grades respectively. The idea of tens, with its extensions, is the unifying theme of the first four grades and permeates all the discussions of the remaining grades. A chapter dealing with teachers' self-improvement is an interesting feature. It contains statements of a number of theories with the author's concise evaluation of each.

Wheat, Harry Grove, *Psychology and Teaching of Arithmetic*. Heath, 1937. Pp. 591. \$4.25.

This book combats belief that learning about arithmetic through contacts with applications in a material world is sufficient to provide understanding. Emphasis is placed upon number development as a product of man's thinking and the teaching of relations existing between aspects of number rather than upon the usual principles of diagnosis, analysis of pupil errors, and testing procedures. The text is very critical of the "social utility" concept as a criterion for selection of pupil experiences.

Wilson, G. M. *et al*, *Teaching the New Arithmetic*, Second Edition. McGraw-Hill, 1951. Pp. 484. \$4.50.

The authors attempt to secure a "social-utility" motivation toward the teaching of numbers and the procedures. Emphasis is placed upon the importance of adapting the subject matter to the maturity of the pupil, and the need for teacher autonomy in the classroom in directing the pupil's experiences. Process and methods are discussed individually; one section deals with research and purpose of written problem work. "Social utility" is stressed as the criterion for selection of pupil experiences.

A SELECTED, ANNOTATED BIBLIOGRAPHY FOR SECONDARY MATHEMATICS TEACHERS

MILES C. HARTLEY, CHICAGO UNDERGRADUATE DIVISION, UNIVERSITY OF ILLINOIS

Abbott, Edwin A., *Flatland*. Sixth Edition. Dover. Clothbound, \$2.25, paperbound, \$1.00.

A popular treatment of the fourth dimension in fairy story form.

Anderson, Raymond W., *Romping through Mathematics*. Knopf, 1948. Pp. 150. \$3.00.

An interesting account of the story of mathematics through four thousand years.

Andrews, F. Emerson, *New Numbers*. Essential, 1944. \$2.50.

A case for base twelve as a base for our number system.

Arkin, H. and R. R. Colton, *Graphs, How to Make and Use Them*. Harper, 1936. \$3.50.

A treatise on the techniques of graphing.

Bakst, Aaron, *Mathematics, Its Magic and Mastery*. Second Edition. Van Nostrand, 1952. \$6.00.

Mathematics seen in the light of its versatility in various fields of endeavor. An inexhaustible source of amusement in mathematics and an understandable discussion of mathematics.

Bell, E. T.—

The Development of Mathematics.⁶ \$7.00.

The Magic of Numbers.⁶ McGraw-Hill, 1946. \$5.00.

Mathematics, Queen and Servant of Science. McGraw-Hill, 1951. \$5.00. Especially suitable for collateral reading in the last year of high school for students who hope to have some understanding of what mathematics is and how it serves science.

Men of Mathematics.⁵ \$6.00.

Breslich, E. R., *Problems in Teaching Secondary School Mathematics*. University of Chicago Press, 1931. \$3.00.

A very complete discussion of the teaching of specific topics.

Brinton, Willard C., *Graphic Presentation*. Brinton, 1939. Pp. 512. \$5.00.

A handbook of graphs. A thorough study of nearly every type used in engineering, business, advertising, and other fields. Each type discussed is illustrated with several examples. Limitation and advantages in the use of each type are clearly shown.

Buswell, G. T. and Lenore John, *Diagnostic Studies in Arithmetic*.⁵

Christofferson, H. C., *Geometry Professionalized for Teachers*. Christofferson, 1933.

A useful book for any geometry teacher; indispensable for the beginning teacher. Contains a wealth of material to challenge superior classes and pupils. Written to review and extend geometric concepts on the college level and to serve as a guide to the teaching of geometry.

Conant, L. L., *The Number Concept*. Macmillan, 1923. \$3.90.

Most useful parts for high school pupils are the chapters on "Counting" and on the "Origin of Number Words."

Congdon, A. R., *Course in Remedial Arithmetic for High School Pupils*. Teachers College and University Extension Division, University of Nebraska, 1937.

Three separate booklets: *Material for the Pupil*, *Tests*, and *Teacher's Manual* including keys for both exercises and tests. Contains diagnostic tests followed by remedial units to be worked by the student if he fails on the tests. Mastery tests are in a separate booklet. Provides for each pupil working independently on his own difficulties at his own speed.

⁵See same title in the Arithmetic Section for description

⁶See same title in the Junior College Section for description

Courant, R. and H. Robbins, *What Is Mathematics?*⁶ Oxford University Press. \$5.00.

Crawford, R. P., *Think for Yourself*. McGraw-Hill. \$3.00.

Cundy, H. Martyn and A. P. Rollett, *Mathematical Models*. Oxford University Press, 1952. \$5.50.

Detailed instructions for making a large number of models including dissections, loci, envelopes produced by folding, drawing and stitching, tessellations, polyhedra, mechanical paradoxes, simple machines for solving equations and linkages.

Dantzig, T., *Number: The Language of Science*.⁵ Third Edition. \$4.50.

DeGrazia, Joseph, *Mathematics Is Fun*. Gresham, 1948. \$2.75.

Contains 196 puzzles ranging from elementary to intricate and their solutions.

Dresden, Arnold, *Invitation to Mathematics*. Holt, 1936. \$3.25.

Gamow, G. —

Mr. Tompkins in Wonderland. Macmillan, 1940. \$2.75. Relativity of space and time, curved space and gravitation, and the quantum of action described in story form. Only the first four chapters are for the high school pupil.

One, Two, Three — Infinity. Viking. \$4.75. An interesting exposition of our number system.

Gardner, Randolph Scott, *Instruments for the Enrichment of Secondary School Mathematics*. Bookstore, New York State College for Teachers, 1951. \$2.50.

The four parts are Measuring Instruments, Calculating Instruments, Miscellaneous Instruments, and Field Instruments. Each instrument is introduced by a historical study, followed by an explanation of underlying mathematical theory and ending with exercises for solution.

Gilles, William F., *The Magic and Oddities of Numbers*. Vantage, 1953. \$2.75.

A collection of mathematical oddities, recreations, and stunts ranging from properties of the number nine to magic squares.

Hartley, M. C., *Patterns of Polyhedrons*, Revised Edition. Edwards, 1948. Pp. 45. \$1.25.

Instructions and patterns for making cardboard models of one hundred geometric solids.

Heath, R. V., *Mathemagic*. Simon and Schuster, 1933. \$1.75.

Heller, F. M., *Mathematics — Queen of the Sciences*. Wilson, 1938.

Bibliography of materials for atmosphere and background; for elementary and high school pupils.

Hills, E. Justin, *A Course in the Slide Rule and Logarithms*. Ginn, 1950. \$1.40.

Hogben, L. T., *Mathematics for the Million*.⁵

Holmes, R. W., *The Rhyme of Reason*. Appleton-Century, 1938. \$3.50.

"An invitation to accurate and mature thinking." The secondary school pupil will be most interested in the chapters on "How Games Are Made" and "Mathematics as a Game." There are twenty-five brain teasers in the Appendix.

Hooper, A., *Makers of Mathematics*. Random, 1948.

Dry as dust notion. . . . swept away; student introduced to the fascination not only of the story of mathematics and mathematicians but also of actual mathematical processes.

Horton, H. L., *Mathematics at Work*. Industrial Press, 1949. \$7.00.

Practical applications of arithmetic, algebra, trigonometry, logarithms to engineering.

Infeld, L., *Whom the Gods Love*.⁶ 1948. \$4.00.

Jeans, J. H. —

Stars in Their Courses. Cambridge University Press, 1931. \$1.95. A book with a wealth of astronomical knowledge written in non-technical language.

The Universe Around Us. Cambridge University Press, 1929. \$5.00. A brief and simple account of the methods and results of modern astronomical research.

Jones, B. W., *Elementary Concepts of Mathematics*. Macmillan, 1947. \$4.75.

A text for college students who have had minimum training and who do not expect to take additional work in mathematics.

Jones, S. I., Nashville, Tenn., *Mathematical Nuts for Lovers of Mathematics and Mathematical Wrinkles for Teachers and Private Learners*, 1923.

Kasner, E. and J. Newman, *Mathematics and the Imagination*. Simon and Schuster, 1940. \$3.75.

A treatment of arithmetical and geometrical fallacies and paradoxes, the underlying idea of calculus and its applications, squaring the circle, and other mathematical problems. A chapter is devoted to π . There is an excellent bibliography.

Kramer, Edna E., *The Main Stream of Mathematics*. Oxford University Press, 1950. \$4.50.

A fascinating history of mathematics beginning with the arithmetic of antiquity and continuing to the mathematics of atomic energy.

Lieber, L. R. and H. G.—

*The Education of T. C. Mits.*³ \$3.50.

The Einstein Theory of Relativity. Rinehart, 1936. Illustrated. \$3.50. A summary of the steps taken by Einstein in establishing his theory and some of the consequences of the theory itself.

Galois and the Theory of Groups. Science Press, 1938. Group theory reduced to its ABC'S.

Logsdon, M. I., *A Mathematician Explains*. University of Chicago Press, 1935. \$3.50.

Bridges elementary to higher mathematics.

Loomis, Elisha, *The Pythagorean Theorem*. Mohler, 1927.

Gives a large number of proofs of this famous theorem.

Machovina, Paul E., *A Manual for the Slide Rule*. McGraw-Hill, 1950. 75c.

Gives the usual history, explanation of construction, classification of slide rules, and helpful suggestions for the selection and care of the instrument. Includes eight detachable problem sheets, each containing a number of practical exercises.

Manning, H. P., *Fourth Dimension*. Peter Smith, 1934.

A popular treatment of the theory of the fourth dimension.

Mathematics in General Education.⁵

McKay, H.—

Odd Numbers or Arithmetic Revisited.⁵ \$2.50.

The World of Numbers. Macmillan, 1946. \$2.50. "Mathematics is a way of looking at things." The author gives a mathematical interpretation of the universe.

Members of the Dept. of Mathematics of the University High School of The University of Chicago, *Mathematics Instruction in the University High School*. University of Chicago Press, 1940.

A running account of the trials and errors in teaching mathematics in The University of Chicago High School, followed by a list of the aims of mathematics teaching, a description of courses, a review of teaching procedures, and two plans for teaching a unit—one in geometry and the other in algebra. Contains remedial and enrichment suggestions also.

Merrill, H. A., *Mathematical Excursions*. Bruce Humphries, 1934.

Gives many helpful facts to enrich classroom materials.

Mueller, C. H., *Geometric Concepts*. Wiley, 1931. \$1.96.

An intuitive method of approach to geometry.

National Council of Teachers of Mathematics Yearbooks—

The Place of Mathematics in Secondary Education. Fifteenth Yearbook, 1940. \$3.00. The most important contribution to mathematical education since the 1923 Report of the National Committee on Mathematical Requirements. Excellent chapters are the first two on aims and objectives and the seventh on the "Problem of Retardation and Acceleration."

Arithmetic in General Education. Sixteenth Yearbook, 1941. \$3.00. This book endorses the "meaning theory." Based on a series of nineteen pronouncements with reference to arithmetic as a phase of the child's school and out-of-school experiences it classifies these under four general headings: selection and content, organization and grade placement, methods of teaching, and measurements. Two hundred selected references. Valuable for any teacher of arithmetic.

Multi-sensory Aids in the Teaching of Mathematics. Eighteenth Yearbook, compiled by a committee of the National Council of Teachers of Mathematics, 1945. \$3.00. A fascinating collection of devices for gaining attention, interest, and understanding in the field of elementary mathematics. Should be in the library of every teacher of mathematics.

Surveying Instruments — Their History and Classroom Use. Nineteenth Yearbook, by Edmond R. Kiely, 1947. \$2.00. In the first 238 pages is found the history of all the early measuring and surveying instruments. In the last 121 pages there are many interesting exercises that may be useful in the teaching of mathematics.

The Metric System of Weights and Measures. Twentieth Yearbook, 1948. \$2.00. This yearbook supplies a comprehensive view of metric usage at the present time. It surveys the history, nature, and advantages of the system and offers specific programs for its adoption and general use.

Northrop, Eugene P., *Riddles in Mathematics.* Van Nostrand, 1944. \$3.75.

Devoted exclusively to paradoxes taken from arithmetic, geometry, algebra, probability, logic, and higher mathematics.

Sanford, Vera., *A Short History of Mathematics.*⁵

Sawyer, W. W., *Mathematicians' Delight.* Pelican, 1949. Pp. 238. 50c.

A popular book "designed to convince the general reader that mathematics is not a forbidding science, but an attractive mental exercise." Good chapters are "The Dread of Mathematics," "The Strategy and Tactics of Study," and "How to Forget the Multiplication Table."

Schaaf, W. L., Editor, *Mathematics — Our Great Heritage.*⁶ \$3.50.

Schuster, C. N. and F. L. Bedford, *Field Work in Mathematics.* American Book, 1935.

Instruments and their use in practical applications of mathematics.

Shackle, G. L. S., *Mathematics at the Fireside.*⁵ Cambridge University Press, 1952. \$3.25.

Smith, D. E. and J. Ginsberg, *Numbers and Numerals.*⁵ Teachers College, Columbia University, 1937. 50c.

Steinhaus, H., *Mathematical Snapshots.* Revised Edition. Oxford University Press, 1950. \$4.50.

A heterogeneous collection of interesting mathematical facts and applications. Much of the material is suitable for bulletin board exhibits. Illustrations in two colors are used for the work in two dimensions.

Struik, D. J., *A Concise History of Mathematics.* 2 vols. Dover, 1948. Pp. 124 and 174. Cloth-bound, \$3.00; Paperbound, \$1.60.

Volume I is a well-told story of mathematics from its beginning to the early seventeenth century. Volume II covers the seventeenth, eighteenth, and nineteenth centuries.

Weeks, R., *Boy's Own Arithmetic.*⁵ \$2.50.

Yates, R. C.—

*A Handbook on Curves and Their Properties.*⁶ \$3.50.

The Trisection Problem. Edwards, 1947. A brief history and a proof of the impossibility of trisecting an angle by the use of a ruler and compass alone. A gem for every teacher of plane geometry; contains many exact and approximate solutions, historical notes, and interesting comments.

A SELECTED, ANNOTATED BIBLIOGRAPHY FOR JUNIOR COLLEGE LIBRARIES

PHILLIP S. JONES, UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN

Even in early biblical days it was written, "Of making many books there is no end." (Ecclesiastes XII, 12). A simple consideration of combinations shows that the making of book lists must be of equal or greater endlessness. But in a hurrying world, selection is always a necessity and well-selected books an ever present stimulus and aid to scholarship.

The following list reflects the opinion of the writer alone. It was compiled subject to the following criteria and restrictions: (1) Fifty books were to be listed. (2) These books, to be of most value in junior college libraries, should largely be usable by persons with a mathematical background of calculus or less. However, the needs of the instructors, superior students, and mathematics clubs should not be ignored. (3) Although reading in foreign languages is fun and a broadening experience in many ways (one discovers both the universal nature of mathematics and some interesting variations in notation, terminology, and manner of approach), nevertheless the books listed were restricted to those in English. (4) Textbooks were included only if they were in some way substantially "different" in approach or content. (5) Books published prior to 1940 were included only if new editions, or at least reprintings making out-of-print items newly available, have been made since that time. This last restriction was justified by the existence of several similar lists for periods prior to 1940 and 1941. To compensate partially for these restrictions three preliminary lists have been prefaced to the list of books. These lists are (1) a summary of earlier bibliographies, (2) the names and addresses of American publishers and distributors of foreign works, (3) the periodicals which regularly carry lists and reviews of books of this type.

BIBLIOGRAPHIES AND BOOK LISTS

Lloyd, Daniel B.—

"Bibliography of Popular Mathematics," *School Science and Mathematics*, Vol. 38 (1938), Pp. 186-193. "A Golden Decade of Popular Mathematics," *The Mathematics Teacher*, Vol. 48, May, 1948, Pp. 210-217.

Mathematical Association of America—

"A List of Mathematical Books for Schools and Colleges," *American Mathematical Monthly*, Vol. 24 (1917), Pp. 368-376. This list of 160 books was compiled by the Library Committee of the Association. The books are grouped for Freshmen, Sophomores, Juniors, Seniors, and First Year Graduates.

"A Suggested List of Mathematical Books for Junior College Libraries," *American Mathematical Monthly*, Vol. 32 (1925), pp. 462-468. This list of 150 titles by the members of the Mathematics Department of the University of California includes some items from the earlier list. Books are classified as elementary or advanced.

"Report of the Committee on Assigned Collateral Reading in Mathematics," *American Mathematical Monthly*, Vol. 35 (1928), pp. 221-228. This list of 51 books is appended to a report suggesting ways to use collateral reading in freshman and sophomore classes. It is classified as "I. History — Antiquity; II. History — Middle Ages and Modern Times; III. Problems, Miscellany, Philosophy"; and "Additional References Suggested for Instructors."

"Reading in the Literature on Teaching with Special Reference to Mathematics," *American Mathematical Monthly*, Vol. 42 (1935), pp. 472-476. This report of a sub-committee of the Commission on the Training and Utilization of Advanced Students of Mathematics includes books and articles largely of an "educational" nature.

"A Selected List of Mathematics Books for Colleges," *American Mathematical Monthly*, Vol. 48 (1941) pp. 600-609. Planned as a continuation of or supplement to the first two lists published by the Association.

"Books for Clubs"; "Club Topics — Bibliographies." These lists were printed in the "Mathematics Clubs" section of the *American Mathematical Monthly* under the editorships of F. W. Owens, Helen B. Owens, E. H. C. Hildebrandt, J. S. Frame. They are to be found in the following issues: Vol. 44, pp. 656; Vol. 45, pp. 44, 183, 245, 317, 358, 688; Vol. 46, pp. 45, 233, 294, 650; Vol. 47, pp. 106, 313, 484; Vol. 49, pp. 117, 466.

Mathematical Association of London—

List of Books Suitable for School Libraries. Revised Edition, 1936. "School Libraries List," *Mathematical Gazette*, Vol. 32 (1947), Supplement pp. XI-XII. These are English lists.

Mohrhardt, Foster E., *A List of Books for Junior College Libraries*. Chicago: American Library Association, 1937. Mathematics, pp. 219-222.

Shaw, Charles B. —

A List of Books for College Libraries. Second Preliminary Edition. Chicago: American Library Association, 1931. Mathematics, pp. 457-476.

A List of Books for College Libraries, 1931-38. Chicago: American Library Association, 1940. Mathematics, pp. 155-161. This is a supplement to, not a revision of, Shaw's first book.

SOURCES OF FOREIGN WORKS

During the war, many foreign, especially German, mathematical works were reproduced in this country by photo-offset or lithograph procedures. The first three publishers below are responsible for the greatest number. The fourth publisher is also a dealer in foreign books and periodicals.

Chelsea Publishing Company, P. O. Box 55, Washington Bridge Station, New York 33, New York.

Dover Publications, Inc., 1780 Broadway, New York 19, New York.

Edwards Brothers, Inc., Ann Arbor, Michigan.

Hafner Publishing Company, Inc., 31 East 10th Street, New York 3, New York.

PERIODICALS

The American Mathematical Monthly, *The Mathematics Teacher*, *School Science and Mathematics*, *Scripta Mathematica* all carry reviews, bibliographies, and articles of interest and value to junior college teachers and students. Additional American journals of this type are:

Mathematics Magazine, \$3.00 per year (5 issues). Address subscriptions to Inez James, 14068 Van Nuys Blvd., Pacoima, California. This is a continuation of the *National Mathematics Magazine*. The articles are largely expository at varied levels of difficulty including a series requiring only algebra and geometry. Includes Reviews, Problems and Questions, and Mathematical Miscellany.

The Pentagon, \$2.00 per two years (4 issues). 310 Burr Oak St., Albion, Michigan. This is designed especially for undergraduate students and is published by Kappa Mu Epsilon, national honorary mathematics fraternity.

BOOKS

ALGEBRA

Knebelman, M. S. and T. Y. Thomas, *Principles of College Algebra*. Prentice-Hall, Inc., 1942. \$3.80; text edition, \$2.85.

Algebra developed from postulates. A text, but one containing more rigor and somewhat more advanced topics than in the usual college algebra.

Littlewood, D. E., *The Skeleton Key of Mathematics, A Simple Account of Complex Algebraic Theories*. Longmans, 1949. \$2.40; text edition, \$1.80.

Algebraic integers, groups, algebras treated "simply." Starts easily, gets harder, but is stimulating.

Meserve, Bruce E., *Fundamental Concepts of Algebra*. Addison-Wesley, 1953. \$6.50.

A modern treatment of the foundations of our number system followed by topics from number theory, theory of equations, and the theory of constructibility.

Ore, Oystein, *Number Theory and Its History*. McGraw-Hill, 1948. \$5.00.

Amateurs and students with only elementary collegiate mathematics will find many of the topics selected for their "systematic and historical importance" simply presented and readable.

Weiss, M. J., *Higher Algebra for the Undergraduate*. Wiley, 1949. \$3.75.

Topics from modern algebra: groups, rings, fields, matrices, in addition to some theory of equations for undergraduates of some maturity.

GEOMETRY AND TRIGONOMETRY

Several items, especially those by Klein, Kraitichik, and Yates, listed later under "Miscellaneous" might be included here.

Davis, D. R., *Modern College Geometry*. Addison-Wesley, 1949. \$4.50.

Chiefly the geometry of the triangle and circle; includes a treatment of inversion and the famous Greek problems.

Frame, J. S., *Solid Geometry*. McGraw-Hill, 1948. \$4.00.

A non-conventional text emphasizing mensuration and drawing with a patented "tri-metric ruler," as well as proofs. Uses only the cosine in measuring angles in space. Includes a chapter on projections and maps.

Hilbert, David and S. Cohn-Vossen, *Geometry and the Imagination*. Chelsea, 1952. \$6.00.

A translation of a famous German book treating topics from advanced mathematics — solid analytic and differential geometry, projective geometry, topology — from a relatively elementary viewpoint.

Kells, L. M., W. F. Kern, and J. R. Bland, *Plane and Spherical Trigonometry With Applications*. McGraw-Hill, 1951. \$3.25 without tables; \$4.00 with tables.

The material on navigation and nautical astronomy is unusually complete and suggestive.

Murnaghan, F. D., *Analytic Geometry*. Prentice-Hall, Inc., 1946. \$5.00; text edition, \$3.75.

A unified approach to analytic geometry, for Freshmen, using vectors and matrices.

Olmsted, J. M. H., *Solid Analytic Geometry*. Appleton-Century, 1947. \$4.00.

A chapter on determinants and matrices is included and their use is emphasized; also interesting paragraphs on four-dimensional and complex spaces.

Wolfe, H. E., *Introduction to Non-Euclidean Geometry*. Dryden, 1945. \$5.00.

Although the projective and analytic aspects of the subject are slighted, it is precisely the synthetic approach and the well written introductory chapters on the foundations and history of the subject which make this an excellent book for beginners, independent readers, and class reports.

CALCULUS

Courant, R., *Differential and Integral Calculus*. 2 vols. Interscience, Vol. I., 1937, Second Edition, \$6.00. Vol II., 1936, \$7.50.

Its current availability as a result of being reprinted in this country warrants the inclusion of this older book. Its compendiousness, together with its attention to motivation, intuition, and application, as well as rigor, earn it a place in every library.

"GENERAL MATHEMATICS" TEXTS

The term "general mathematics" has been variously used on the college level to include "fused" presentations of classical materials, review and drill in elementary concepts, historical presentations, and elementary approaches to postulational procedures. Here we list three books which, although they include something from each of the above classifications, have an objective of their own in terms of surveying the nature of mathematical thinking, systems, modern and ancient ideas for non-science, non-mathematics majors. They are texts which make good reading for almost any interested layman. Well-selected bibliographies are included.

Cooley, Hollis R., David Gans, Morris Kline, and Howard E. Wahlen, *Introduction to Mathematics. A Survey Emphasizing Mathematical Ideas and Their Relations to Other Fields of Knowledge*. Second Edition. Houghton Mifflin, 1949. \$4.25.

Jones, Burton W., *Elementary Concepts of Mathematics*. Macmillan, 1947. \$4.00.

Richardson, Moses, *Fundamentals of Mathematics*. Macmillan, 1941. \$3.25.

EXPOSITIONS AND POPULARIZATIONS

Bell, E. T. —

The Magic of Numbers. McGraw-Hill, 1946. \$5.00. A largely historical but not chronological account of episodes in the development of logic, mathematics, and freedom of thought as well as number.

Mathematics, Queen and Servant of Science. McGraw-Hill, 1951. \$5.25. A reworking of two of Bell's earlier books; an excellent semi-popular treatment of the nature of mathematics and its modern developments.

Courant, Richard and H. E. Robbins, *What Is Mathematics?* Oxford University Press, 1941. \$6.50; Educational Edition, \$5.00.

In spite of its correct statement that "understanding of mathematics can not be transmitted by painless entertainment" this book comes close to it in seeking its end, a presentation "as free from emphasis on routine as from forbidding dogmatism which refuses to disclose motive or goal." The chapters on number theory, number system, geometric constructions, axiomatics and geometries, topology, functions and limits may be read separately. Supplementary paragraphs and exercises will challenge the "better" readers, but the extraordinarily sound exposition and mathematics will attract intelligent laymen with the slightest interest in mathematics.

Dubisch, Roy, *The Nature of Number.* Ronald Press, 1952. \$4.00.

An attempt to start with an historical account of the integers, progress through a modern treatment of a logical development of the complex numbers, and end with some exposition of matrix and other linear algebras for persons with no mathematical background.

Gamow, G., *One, Two, Three — Infinity.*⁷ Viking Press, \$4.75.

Hogben, Lancelot, *Mathematics for the Million.*⁵

Kasner, Edward and James Newman, *Mathematics and the Imagination.*⁷ Simon and Schuster, 1940. \$3.50.

Kramer, Edna E., *The Main Stream of Mathematics.* Oxford University Press, 1951. \$5.00.

Discussion, partially historical, of the relations of mathematics to many other fields: nature, art, logic, relativity, as well as simple presentations of many pure mathematical ideas, such as functions, analytic geometry, calculus, and statistics.

Lieber, Lillian R., *The Education of T. C. Mits.* Revised and enlarged. Norton, \$3.50.

All of the Liebers' books, illustrated by H. G. Lieber, have an unusual style, a format making the prose appear to be blank verse, and deal whimsically but soundly with the nature and topics of modern mathematics, emphasizing axiomatics. Listing all of their books here would upset whatever balance this limited list may have, but they are all recommended.

Schaaf, W. L., Editor, *Mathematics: Our Great Heritage. Essays on the Nature and Cultural Significance of Mathematics.* Harper, 1948. \$3.50.

A well-selected collection of essays, by many authors, containing discussion of the sources, foundations, philosophy, and significance of mathematics, both as the "handmaiden" of science and for its own humanistic bearings.

Titchmarsh, E. C., *Mathematics for the General Reader.* Longmans, 1949. \$2.40; text edition, \$1.80.

A little book of 159 pages which begins with counting and ends with integral calculus. A friendly, easy, general-reader account of elementary mathematics. Not romanticized, but fun to read.

Whitehead, A. N., *An Introduction to Mathematics.* 12th Impression; First American Edition. Oxford University Press. \$2.00.

A long-needed, slightly revised reprinting of an excellent exposition of the basic ideas and themes of classical elementary mathematics, algebra, and trigonometry through calculus.

HISTORY AND BIOGRAPHY

See also J. T. Higgins, "Biographies and Collected Works of Mathematicians," *American Mathematical Monthly*. Vol. 51 (1944), pp. 443-445.

Archibald, R. C., *Outline of the History of Mathematics.* Sixth Edition. Mathematical Association of America, 1949. \$1.00.

Contains a synopsis, discussion, and an excellent extensive "Literature List and Notes."

⁷See same title in the Secondary School Section for description

Bell, E. T. —

The Development of Mathematics. Second Edition. McGraw-Hill, 1945. \$7.00. The best display of the themes and lines of development in the history of mathematics, especially modern mathematics. Interestingly written. Although parts of it are too advanced for most undergraduates, it should be in every library.

Men of Mathematics.⁵

Boyer, C. B., *Concepts of the Calculus*. Hafner, 1949. \$5.50.

The only comprehensive tracing in English of the development of the concepts of the calculus from Eudoxus and Archimedes through the "rigorous formulation" begun by Cauchy.

Coolidge, Julian, *The Mathematics of Great Amateurs*. Oxford University Press, 1949. \$5.00.

Biographies with an emphasis on the mathematics of such persons as Dürer, Da Vinci, Pascal, L'Hospital, Diderot.

Dantzig, Tobias, *Number: The Language of Science*.⁵

Eves, Howard, *An Introduction to the History of Mathematics*. Rinehart, 1953. \$6.00.

Not a complete history of mathematics, but an excellent text for a course with many stimulating suggestions for special projects and problems.

Infeld, Leopold, *Whom the Gods Love: The Story of Evariste Galois*. McGraw-Hill, 1948. \$4.00.

Romanticized and non-mathematical but still both interesting and worthwhile.

Ore, Oystein, *Cardano, The Gambling Scholar*. Princeton University Press, 1953. \$4.00.

A biography emphasizing the work in probability of the man who was also an algebrician, physician, cryptanalyst.

Struik, D. J., *A Concise History of Mathematics*.⁷

THE FOUNDATIONS AND PHILOSOPHY OF MATHEMATICS

Clifford, W. K., *The Common Sense of the Exact Sciences*. Knopf, 1946. \$4.00.

The preface by Bertrand Russell and introduction by the Editor, James R. Newman indicate that this is not a revision of the discussion of number, space, quantity, position, and motion which appeared in the first, 1885, posthumous edition. The essays are still stimulating and profitable.

Poincaré, Henri —

The Foundations of Science. Science Press, 1946. \$5.00. A new printing of the translation of the famous Frenchman's discussions of mathematical reasoning, geometry, space, force, and motion.

Science and Hypothesis and *Science and Method* are now available, in translation, from the Dover Publishing Company at \$2.50 each; paper covered, \$1.25 each.

Stabler, E. R., *Introduction to Mathematical Thought*. Addison-Wesley Press, 1953. \$4.50.

The nature of mathematics, logic, and an axiomatic system with examples from elementary algebra and geometry together with an introduction to the axioms for a field and to Boolean algebra.

Wilder, R. L., *Introduction to the Foundations of Mathematics*. Wiley, 1952. \$5.75.

A more advanced treatment than Stabler's, with an emphasis on sets, the continuum, different "schools" in the foundations of mathematics.

APPLICATIONS OF MATHEMATICS

The library should include a selection of easy texts in statistics, mathematics of finance, shop mathematics, navigation, surveying, even though these subjects are not taught. William L. Schaaf's "A Survey of the Recent Literature of Military Mathematics," *Scripta Mathematica*, Vol. 11 (1945), pp. 57-74, 121-137, is broader and more helpful in some of these fields than its title would indicate.

Cell, J. W., *Engineering Problems Illustrating Mathematics; A Project of the Mathematics Division of the Society for Promotion of Engineering Education*. McGraw-Hill, 1943. \$3.50.

This is a teacher's handbook which even those not teaching engineers may use profitably.

Mellor, J. W., *Higher Mathematics for Students of Chemistry and Physics*. Fourth Edition. Dover, 1946. \$4.50.

Reddick, H. W. and F. H. Miller, *Advanced Mathematics for Engineers*. Second Edition. Wiley, 1947. \$6.00.

In both of the above books much of the mathematics is above the sophomore level but the teacher may select materials from them and the student may have his interest and appreciation stimulated by scanning the books themselves.

Thompson, Sir D'Arcy W., *On Growth and Form*. Cambridge University Press, 1942. \$15.00.

A mathematical approach to some phases of biology.

Wolfe, John H. and Everett R. Phelps, *Practical Shop Mathematics*. Vol. I, Elementary, 1948; Vol. II, Advanced, 1949. McGraw-Hill, \$3.00 and \$3.25 respectively.

MATHEMATICAL RECREATIONS

Many more titles and bibliographic references may be found in William L. Schaaf's "List of Works on Recreational Mathematics," *Scripta Mathematica*, Vol 10, (1944), pp. 192-200.

Ball, W. W. R., *Mathematical Recreations and Essays*. Macmillan, 1947. \$3.95.

This is the classical, standard English work, much improved by H. S. M. Coxeter. Much miscellaneous mathematical and historical material is included, such as a chapter on the famous Greek problems and one on calculating prodigies.

Kraitchik, M., *Mathematical Recreations*. Second Edition. Dover, \$3.56; paper cover, \$1.60.

A revised translation from the French. Numerical pastimes, arithmetical-geometrical questions, the calendar, magic squares, permutational problems, games, problems of queen and knight.

Northrop, E. P., *Riddles in Mathematics, A Book of Paradoxes*. Van Nostrand, 1944. \$3.75.

Paradoxes and fallacies—in arithmetic, algebra, geometry, probability, logic, and higher mathematics.

MISCELLANEOUS

Abbott, Edwin A., *Flatland*. Dover, \$2.25; paper cover, \$1.00. Barnes and Noble, \$2.00.

Reprints of a famous imaginative story of the dwellers in a plane.

Cundy, H. M. and A. P. Rollett, *Mathematical Models*. Oxford University Press, 1952. \$5.50.

Many stimulating suggestions, even to comments on materials and tools, for making mathematical models. More advanced, mathematically, than the *Eighteenth Yearbook of the NCTM*.

Hadamard, J., *The Psychology of Invention in the Mathematical Field*. Revised Edition. Princeton University Press, 1949. \$2.50.

An analysis of how original mathematical ideas are discovered or invented.

James, Glenn and R. C. James, Editors, *Mathematics Dictionary*. Van Nostrand, 1949. \$8.50; text edition, \$6.50.

This edition is more complete and accurate than the first. It includes tables, constants, symbols, and definitions of terms in elementary and many fields of advanced mathematics.

Kraitchik, Maurice, *Alignment Charts*. Van Nostrand, 1944. \$3.00.

Makes use of the three-rowed determinant and displays diagrams for investment problems.

Klein, Felix, *Elementary Mathematics from an Advanced Standpoint*. Vol. I, Arithmetic, Algebra, Analysis. Vol. II: Geometry. Dover, \$3.25 each; paper covers, \$1.50.

These two reprints have many mathematical suggestions and new viewpoints for the teacher which will clarify his own insight and suggest presentation devices and enrichment material.

National Council of Teachers of Mathematics, *Eighteenth Yearbook, Multi-Sensory Aids in the Teaching of Mathematics*.⁷

Polya, G., *How to Solve It, A New Aspect of Mathematical Method*. Princeton University Press, 1945. \$3.50.

The best presentation known to the writer of heuristic, both as a teaching device and as a solving procedure. Valuable for both teacher and pupils.

Steinhaus, H., *Mathematical Snapshots*. Oxford University Press, 1950. \$6.50.

A treasury of interesting oddments.

Weyl, Hermann, *Symmetry*. Princeton University Press, 1952. \$3.75.

An advanced mathematical approach to the mathematics in art and nature, but well illustrated and quite readable.

Yates, R. C. —

Geometrical Tools: A Mathematical Sketch and Model Book. Educational Publishers, 1949. A wealth of enrichment and club ideas: folds and creases, linkages, constructions with restricted means and special tools.

A Handbook on Curves and Their Properties. Edwards Brothers, 1947. \$3.50. A teacher's handbook listing curves alphabetically and summarizing much little known but useful enrichment data about each.

*The Trisection Problem.*⁷

Mathematics is not the discoverer of laws, for it is not induction; neither is it the framer of theories, for it is not hypothesis; but it is the judge over both, and it is the arbiter to which each must refer its claims; and neither law nor theory explain without the sanction of mathematics. — Benjamin Peirce

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Mathematics is the queen of sciences and arithmetic the queen of mathematics. She often condescends to render service to astronomy and other natural sciences, but in all relations she is entitled to first rank. — Karl Friedrich Gauss

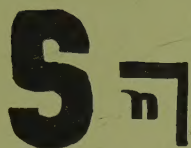
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TEACHING

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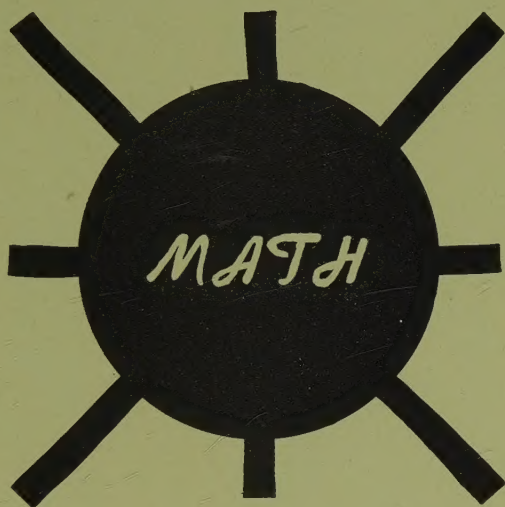
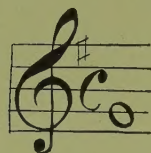
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